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Otto Lerch

Rational Therapy



BY

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TO THE MEMORY OF MY WIFE,

BETTY TORRY LERCH,

Who encouraged me to undertake the work,
and helped me to finish it,
this book is lovingly dedicated.

FOREWORD

As a teacher of graduates, I have been impressed with the dissatisfaction existing with the state of Therapeutics, which appears to most physicians chaotic.

I have tried in this book to give a guide in the treatment of the sick by emphasizing that *blood alone cures*, and that all methods used to treat disease must serve to purify it, and bring it where it is needed.

I have discussed the various therapeutic methods with this idea in view and have given the essentials of each, enough I believe, for immediate use, and to serve as an introduction to special works, which the book is not intended to replace. To accomplish this, each chapter had to be short, an outline only of the vast material it represents. This applies especially to the one on drugs, almost sketchy in character, yet like the others, containing the essentials of this method of treatment. It has been my aim to make this book useful for every day practice.

The healing force of Nature has been explained in the Introduction. The chapter on Fresh Air contains an outline of the treatment with Air Bath, Sun Bath and Climate.

In the chapter on Diet, I have tried to show that the condition of the patient, his occupation, the climate in which he lives and his assimilating power of food, are all important factors, usually not enough emphasized by writers on this subject; that improvement is best and most easily controlled by weight, appearance and subjective feeling, and that in general practice a close figuring of calorics becomes a negligible factor.

I have called attention to the importance of rest in the prevention and treatment of disease and given an explanation not found in other works.

The principles of exercise and massage, hydrotherapy and electrotherapy, as well as their application in disease, have been fully discussed.

The treatment with hyperemia has received full attention, because it proves that even impure blood may cure when the seat

of injury gets a sufficient quantity. That far better results may be obtained when other methods are combined with it to correct faulty distribution and composition is evident.

I am the first to offer, I believe, the explanation of the marvels of psychotherapy, regulating the blood supply to organs and tissues through higher centers.

Vaccine, serum and organo-therapy, subjects usually difficult to understand, are presented in a simple form, in conformity with the idea which has guided me throughout, namely, that these methods have to serve to make the blood and its distribution more perfect.

Drugs have been divided not as is customary, alphabetically according to action as used, or according to their chemical composition, but in active principles resembling Hormones, antiseptics reminding the immune sera and in mineral compounds, resembling the hormones by ionisation, and in their salt action the mineral components of the food believing that this division would aid in the understanding of their action. Though journal literature and text books have been freely used, the book is not a work of compilation, but embodies my experience gained in practice and teaching. Parts of the chapters on diet, rest, hydrotherapy and psychotherapy, have been previously published in periodicals.

I wish to thank Dr. A. Fossier for valuable suggestions and other help.

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ERRATA

Page 1, Line 7—Should read—To repair the injuries inflicted upon it.

Page 1, Line 8—Should read—Healing power of nature should be omitted.

Page 14, Line 28—Should read—Animal and vegetable microbes stop motion, etc.

Page 23, Line 25—Should read—Vesicles before pustules have time, etc

Page 45, Line 4—Should read—Rectal feeding or a subcutaneous injection.

Page 49, Line 33—Should read—In intestinal strictures, etc.

Page 99, Last Line—Should read—If the disease is early recognized, etc.

Page 158, Line 7—Should read—The obstruction by enemas.

Page 170, Line 13—Should read—Almond meal and brand, etc.

Page 194, Line 21—Should read—Be prescribed with caution, etc.

Page 225, Line 15—Should read—Placed upon the juglum, etc.

Page 230, Line 1—Should read—The phosphorescent rays, etc.

Page 233, Line 19—Should read—Emotional and volitional, etc.

Page 246, Line 26—Should read—Upon which previously impressions have been made. It is the recognition of these conscious processes with which memory, etc.

Page 254, Line 26—Should read—An obstruction to progress, etc.

Page 268, Line 29—Should read—The Railroad Spine and the woman, etc.

Page 270, Line 18—Should read—Disturbed on receipt of shocking news, etc.

Page 278, Line 7—Should read—The bandage was removed one to four hours after and the animal remained in perfect health, etc.

Page 308, Nine 25—Should read—To pass into the alveoli, etc.

Page 325, Line 14—Should read—That the supernatant, clear liquid, etc.

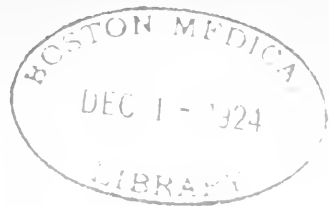
Page 347, Line 9—Should read—He injected five hundred individuals with 30 c.c. of the serum, etc.

Page 381, Line 15—Should read—1:1000 every three hours, etc.

Page 389, Line 35—Should read—There is a gritty matter present, which consist of round particles, aggregated into small masses. The central substance consists of white and gray matter. The blood vessels are small and form very delicate capillary plexuses, etc.

Page 397, Line 38—Should read—The life of nephrectomized animals, etc.





CHAPTER I

“The Vis Medicatrix Naturae”

It is difficult to define force, only known by its effect. Foster (Encyclopædic Medical Dictionary) speaks of the VIS MEDICATRIX NATURÆ as a remedial force or impulse: German, NATUR-HEILUNG, the remedial impulse of Nature, the self recuperative power of the bodily system, independent of medicine. The STANDARD DICTIONARY calls it the capability of living tissue, animal or vegetable, to remedy or remove disease or to repair the healing power of Nature. Frank's MEDICAL DICTIONARY defines it as the healing power of Nature. It is often quoted by clinicians and teachers to explain improvement in patients not thought to be due to treatment.

I advance the theory it is a force that acts through the blood. The blood represents it. It carries nourishment to every cell of the body to select from for its own proper use and in return carries away waste matter to be excreted by way of lungs, kidneys and skin. It contains the means of defense against an invasion of micro-organisms and toxins, and when injury is done it carries the means of repair wherever they are needed.

Bearing this in mind, it is clear how we can assist Nature in her endeavor to cure disease. We have to free the blood from impurities, microbes, and toxic substances and regulate its distribution, so that it can flow with ease where needed. There can be no successful treatment without this object in view and no result can be obtained unless it is at least partially accomplished, no matter what disease we are called upon to treat, acute or chronic, organic or functional.

Three indications present themselves in every case: To remove danger to life, to relieve pain, and to cure disease. Each method of treatment now in use meets those indications more or less, and all purify the blood and influence blood distribution. They produce a greater purity of blood and restore a disturbed equilibrium between the venous and arterial circulation in one particular organ or in the whole organism. Pure blood and a perfect circulation remove danger to life, stop pain, and restore an injured organ to healthy function, if that is still possible.

Blood knits the broken bone, heals the wound and repairs injury to organs and tissues.

Only a correct diagnosis can be a guide to employ therapeutic means in a rational way. We have to know the character of the impurities, and we have to know the particular microbes in order to employ specifics. Drugs, vaccines, antitoxins, serums, organic extracts and the physiological methods cannot be used without a correct diagnosis. All organs, the sexual organs included; make blood, purify it and distribute it, and we have to know which fails to help.

Therapeutic methods act mainly upon the nervous system, and, skillfully employed, will affect certain organs to the exclusion of all others, increase their function or slow it, and act as stimulants or sedatives upon the whole organism or upon single organs. They free organs of excessive blood and waste and create an active or passive hyperemia where needed to cure disease.

There exists at present a great disagreement among clinicians. Some laud the treatment with drugs, others put little faith in it, some put forth their claims for the physiological methods and deny the efficiency of drug treatment, while others, again, rely on one particular method they have especially studied. The view that blood alone cures and that all therapeutic methods must serve to free it from impurities and bring it where it is needed, permits and forces the employment of several or of all to get the best results in the treatment of the sick. The diagnosis will indicate in each case the best combination.

PREPARING THE PATIENT FOR TREATMENT

Before commencing treatment, it is necessary to thoroughly clean mucous membrane and skin, "the covering of the body proper." Both are important organs, which prevent recovery and cause disease, if not kept clean. An abnormal mucous membrane is an open door to any infection. A coated tongue and fetor of the breath are usually expressions of a bad mouth hygiene and not of a diseased stomach, as is commonly believed. A chronic nasal catarrh, or an obstruction, causes mouth breathing, pyorrhoea, decayed teeth and inflamed tonsils, a constant ingestion of pus and pathogenic bacteria. In febrile diseases, and those of the gastro-intestinal tract demanding a liquid or semi-solid diet, the mouth, if not thoroughly cleaned, becomes an incubator of pathogenic bacteria; pneumonia and tuberculosis may follow

grippe, typhoid fever, and malaria;—articular rheumatism may follow tonsillitis; and the diseases of the gastro-intestinal tract and various constitutional diseases are not rarely due to a bad mouth hygiene.

Pathogenic bacteria are constantly present in the mouth and when, under conditions favorable to their growth, they are allowed to multiply and Nature's defenses of the organism are weakened, find ready access in large numbers and give rise to serious complications. A good mouth wash and gargle should be employed and tooth brush and powder freely used after each meal—nose, gums and teeth attended to and the tongue cleaned with an aluminum scraper or the index finger, cotton wrapped around it and dipped in a mild antiseptic solution, care being taken not to cause injury.

In many instances Nature helps herself at the beginning of an acute infectious disease and repeatedly in chronic affections by emptying stomach and bowels. Such efforts should be assisted by washing the stomach and cleaning the bowels with purgation and enemas. The colon is an organ of absorption, as well as a waste pipe. The epithelial cells covering the absorbing glands become paralyzed when too long exposed to the injurious influences of putrifying waste and allow toxic substances to pass, which causes serious disease. The circulation interfered with gives rise to congestion of chest and abdominal organs, and the faulty composition of the blood causes nausea, headache and pain, and will finally affect every organ. Intestinal parasites, micro, and macroscopic, find a favorable soil and furnish an additional cause for local and constitutional diseases.

Though this subject has been discussed in text books and periodicals it is still sorely neglected and frequently patients are met with, suffering from organic disease which can be traced to pyorrhoea and constipation.

An acute infectious disease commences usually with a chill; the blood is central, the skin cold and clammy and the body temperature high. There is no better way to correct the faulty circulation than an enema, followed by free purgation and a hot foot bath, with an ice bag to the head. The chill ceases, the body surface becomes warm, the temperature sinks, a dilated heart contracts to normal size and regains strength, high blood pressure is lowered, and with the clean bowels the patient feels more comfortable, and has a better chance to recover.

In acute and chronic organic disease strict attention to the bowels is important and judicious purgation is often a necessary factor in the treatment of these diseases. There remains a large class of patients, "the neurasthenics and hysterics", all visceropaths that constantly suffer from gastro-intestinal affections, and cleaning of the bowels and keeping them free from putrifying waste is in these cases a necessary condition for recovery.

Considering the indoor life most of the city patients have to lead the character of the food they take, consisting usually of meat, bread, cereals and lard, with a lack of vegetable and fruit necessary for such a life, and the large quantities they ingest, bowel hygiene becomes a matter of importance, not alone for therapeutic, but also for prophylactic purposes.

In appendicitis and in local and diffuse peritonitis, purgatives are dangerous and should not be used; that is, in the beginning and during the acute state; nor in cases where pain in the right iliocolic region suggests it, and in which appendicitis cannot be excluded with certainty. This is the generally accepted view, though a number of physicians discountenance the opium treatment and advise free purgation. High enemas are as dangerous as purgatives—they increase intra-abdominal pressure and peristalsis. Yet constipation is the constant accompaniment of appendicitis and a cleaning of the bowels is a necessity to improve the chances of the patient. In such cases the physician should give the enema himself, avoiding unnecessary exertion and pressure of the inflowing water, considering carefully any complaint of the patient. Glycerine suppositories may be used instead. They serve the purpose and are not dangerous.

CHAPTER II

Fresh Air, Air Bath, Sun Bath and Climate

FRESH AIR

An abundance of fresh air is of the greatest importance in the treatment of the sick. This has been recognized for many years and has been found in many instances alone sufficient to cure. It has been spoken of as "The Fresh Air Treatment"—"Out-of-Door Treatment"—etc. Why a constant and abundant supply of fresh air should prove a powerful factor to recovery is readily understood when we consider that the life process is mainly a process of oxidation and disoxidation, and that to withdraw the necessary supply of oxygen, even for a few minutes, causes death. We wonder why this simple fact has not been appreciated ages ago.

Consumption has taught the necessity of fresh air. A disease essentially of the lungs, it was first to call attention to it and many volumes have been written on the subject. The value of fresh air in consumption is quite fully appreciated, even by the most humble in all quarters of the world; yet it is far less understood that its therapeutic value is just as essential in every disease, infectious or visceral, acute or chronic.

Life depends on a sufficient supply of oxygen. Pure and fresh air, containing it, is needed in abundance to restore the invalid to health. External respiration takes place in the lungs; internal respiration in the tissues, where processes of oxygenation and disoxygenation constantly produce heat and energy—the quintessence of life.

The rules that have been laid down for the treatment of consumptives hold good for all diseases. The advice to live constantly in the open air, and, if that is not possible, to spend hours out-of-doors, is the best that can be given to the sick. "Sleep with windows and doors wide open, but keep out of a draft". It is true that it is better to drink from a running stream than from a stagnant pool. Sleeping in the open or on a porch, the body well protected and the face bathed by a cool, refreshing breeze, is

desirable. On the other hand, experience has taught, that when one particular portion of the face or body is constantly struck by a cold stream of air—"a draft"—serious trouble may be the consequence. A draft chills and disturbs the circulation. Drafts are easily avoided and it is good practice to guard against them.

Sleeping rooms, living rooms, office and working rooms should be well ventilated. Their size and ventilation should be calculated to give an ample supply of fresh air. Special care should be taken for the sleeping room, and its size ought not to be less than 10'x10'x10'. At least eight, or more, out of the twenty-four hours are spent in this room.

Pure air is important in every disease and without it a cure is impossible; with it, prevention and cure can be effected in many cases. If we secure an abundant supply of fresh and pure air, so that every red blood corpuscle can carry oxygen to the organs and tissues of the body, the purified blood flows easily wherever it is needed and physiologic action is increased.

It is unfortunate that every patient cannot be treated with the pure air that can be had in the country, on mountain tops and by the seashore, on hillside and plain. Wherever a sufferer from a chronic disease is able to change from the smoky city to the country and avail himself of the full supply of pure fresh air and sunshine, he will be benefitted. To do so regularly once a year becomes a valuable prophylactic measure, and this fact is so well recognized that a regular exodus takes place and the large cities appear deserted during the summer months. Whoever can afford it emigrates to the country to drink and bathe in sunshine and air, spend the days out-of-doors and return home free of ailments, with vitality increased and resisting power strengthened, well prepared for his winter work. The value of such a vacation, whether needed for treatment, or adopted for prophylactic purposes is invaluable. It restores health, increases working capacity and prolongs life.

It would be futile in many cases to tell patients that they have to go to the country and avail themselves of this great advantage. Poverty or lack of means forces the majority to stay where they are and die; important business interests handicaps others. "I cannot leave"—"I am too poor" or "I would have to give up my position" are answers the physician hears daily. In such cases we have to do the best we can under the circumstances. The air is purer in the suburbs of a city than in its center and the upper stories of a building are to be preferred to the lower ones. With

our present electric transit and elevators in apartment houses many can take advantage of these more favorable conditions. Everybody must be kept out-of-doors as much as possible, take advantage of the parks and squares when not at work and, if possible, spend Sunday in a country neighborhood.

Even in bad weather it is better to spend some time out-of-doors in the open air than to keep indoors for days, afraid of exposure to rain and wind. Clothing must be well attended to, and especially the foot-gear must be as good as can be had. If the feet get wet, a change should be made on entering the room, and clothing especially shoes, stockings and socks, should never be allowed to dry on the body. Chilling of surface, a serious disturbance of the circulation with some infections following, like a cold, grippe, bronchitis, pneumonia, etc., will likely be the consequences.

It ought to be a rule never to go to bed with cold and wet feet. A hot foot bath or splashing up and down in a bath tub, filled ankle deep with cold water—"a-la Kneip" followed by vigorous friction with a rough towel, and if reaction is tardy, with heated towels, till the feet are red and glowing, will prevent trouble by getting the general circulation in good condition.

The old and feeble should be kept indoors during bad weather, and especially during sudden atmospheric changes. Spring and fall are dangerous times for these patients. The aged die principally in the winter months; pneumonia and grippe will usually carry them off. Their organism is too weak to respond to sudden and severe atmospheric changes, they are, therefore, easily chilled. The blood is kept central and visceral congestions, with following infections, may be the consequence. These people feel well and strong under usual conditions. They forget the wear and tear of time, however, and expose themselves and become easy victims of pneumonia, when with due caution this dreaded disease could have been avoided and they could have spent a useful life for many years more. Even the slightest cough or cold must be taken seriously in persons well on in years. They should be treated and kept in bed as if they already had contracted the threatened ailment. It is especially of importance for these patients, as well as for those affected with acute and chronic febrile diseases, that particular attention should be paid to the sick room or rooms, if two rooms, a sleeping and a living room can be had.

In order to keep the air pure, aside from the ventilation, we have to see that all unnecessary furniture and rugs are removed, because they exhale during damp, rainy or foggy weather. An open fireplace is better than a stove: It serves as a ventilator and draws the used up air into the grate. However, any kind of heating will allow proper ventilation.

It is usually not sufficient to tell the patient or his attendants that he needs fresh air. In most cases we have to see that proper provisions are made. Though consumptives realize that to live and get well fresh air is necessary, most persons affected with other diseases are not posted on the subject, and the public needs education in this direction. We have to inspect quarters and when visiting see that the windows are open and that the patient has a sufficient supply of fresh air.

When the patient is kept in bed, the temperature is best observed with a thermometer hung at the bedside at a level with the patient's face—60-70°F. is usually a good temperature in febrile diseases, regulated to suit the patient.

On chilly and damp days it is well to keep a small fire in the grate to dry the air, as well as for ventilation. Dry cold air acts as a tonic and stimulates the circulation, damp and moist air chills and is penetrating.

Out-of-door exercise in cold and dry air is safe and beneficial. During damp and foggy days precaution has to be taken and susceptible patients are better kept indoors. A moist and damp air interferes with a free functioning of the skin.

Temperature changes alone do not cause cold. This is well evidenced by the Turkish bath, when a cold plunge is taken with benefit after a prolonged exposure in the hot rooms. Stokers on steamers come from the hot furnaces of the ship on deck to cool off and expose themselves to the strong sea breeze without catching cold. It is the foul and infected air breathed for hours in crowded rooms, followed by exposure, that causes disease.

The sick and the healthy should sleep alone. Everyone needs all the fresh air he can get. It is a custom that cannot be too severely condemned, for people to share not only the room, but the bed. The foul exhalation of the one will be inhaled by the partner. If people can afford it, they should occupy separate sleeping rooms, and if not, at least separate beds. In case of sickness the physician must insist upon this important point—for the same reason nurses and attendants should be kept out of the

room as much as possible. Lights should not be burned, except in cases of absolute necessity.

Sleeping and living rooms should be well exposed to the sun. Sunlight changes the composition of the air and purifies it. By keeping windows and doors of the sleeping room wide open, a thorough aeration and sunning takes place during the day, and the patient gets the benefit of a perfectly pure air on retiring. A sleeping room can be constructed on the porch, enclosed by solid walls, or awning from 5 to 6 feet in height, leaving an open space of several feet above the bed, so that air and wind can pass freely. The roof should extend several feet outward to keep the rain from beating into the room. Such an arrangement gives perfect protection to the sleeper against drafts and severe winds, and may be used in any climate. This space will keep dry in bad weather on account of the overhead air currents, although the inside rooms may be damp and the furniture covered with moisture.

Another arrangement to furnish the patient with an ample supply of fresh air is to partly close the window, keep the body on the bed inside the room well covered, keep the head outside the covers, and the opening protected by an awning. This and other expedients can be taken advantage of in suitable cases. The object is to furnish the patient with as much pure air as possible under given conditions. Fresh air is a therapeutic agent and must be prescribed.

The character of the disease and its chronicity, together with the climatic conditions and the individuality of the patient, have to prompt directions. The principle that pure blood cures, that well oxygenated blood is purified and easily flows where needed, must not be lost sight of.

THE AIR BATH

Air baths and sun baths were freely used by the Greeks and Romans. This custom fell entirely into disuse in the Middle Ages and has been revived only in recent times.

Either kind of a bath, no matter which, has a direct influence upon the skin—it acts as a thermic agent.

Heat and energy production of the organism is due to oxidation of the food, and in starving animals due to the same process, of body fat and albumin. To keep the body temperature constant.

the heat production has to be regulated, and this is done through a fine and methodic mechanism by way of skin and lungs.

The body loses heat by radiation, conduction, and evaporation of moisture from the skin, which is in immediate contact with the air. Over-production of heat caused by excessive ingestion of food and manual labor increases heat loss. The skin capillaries widen, the blood flows from center to periphery and radiation, conduction and evaporation increase. At the same time more water is lost through shallow and rapid respiration, stimulated from the nerves lodged in the skin. With a sinking of the temperature, heat loss decreases; the skin capillaries contract and the blood flows from periphery to center; respiration deepens, more oxygen is inhaled, oxidation within the organism, especially in the muscles, increases and a larger amount of carbon dioxide is exhaled. The composition of the blood is changed. The contracted capillaries do not allow the red cells to pass; they diminish in number, whereas the leucocytes increase. With the reaction, the capillaries widen, the leucocytosis disappears and the red cells appear in large numbers drawn from every recess and corner. Blood pressure and body temperature rise on exposure to cold air and rapidly sink with the reaction which increases heat loss.

The skin has an excretory function, especially of water. The amount excreted during the twenty-four hours depends on the activity of the sweat-glands, the temperature and saturation of the air with moisture and on atmospheric pressure and air currents.

Sweat contains urea and various toxic substances, which increase during uraemic attacks. Medicaments like mercury, arsenic, iodide of potassium, and other sediments are also found in the perspiration. Water is given off from the skin by visible and invisible evaporation. Saturation and stillness of the atmosphere are unfavorable conditions, causing part of the perspiration to trickle down on the skin and to be absorbed by the clothing.

Sweat production and evaporation is an important means to reduce body temperature. One gram of water needs 580 calories, that is as much heat as is needed to raise the temperature of 580 grams of water by one degree centigrade.

Clothes act like a second skin. They protect the body from excessive heat loss and injury. Suitable clothing enables man to live in any climate from the Equator to the Pole. Cloth is a bad heat conductor. The skin and subcutaneous tissues are good

conductors. The air between skin and clothing keeps the body warm and prevents rapid temperature changes of this air stratum. To be rational it has to be permeable, allowing vapors to pass. The air in the meshes of the cloth causes its permeability. Evaporation depends on the free circulation of air. If the clothes are saturated with moisture, this process is interfered with, and serious disturbances are the consequence. Overheating of the skin, followed by chilliness, and a feeling of great anxiety and discomfort, may cause sickness. Resting in damp clothes causes heat loss by evaporation at a time when the body can least afford it. An ablution with air is necessary to keep in good condition. After undressing the temperature sinks rapidly, to rise as fast, after dressing. This acts as a powerful stimulant to the general circulation.

Clothing interferes with the function of the skin. The air bath, that is an exposure of the naked body to the air, its temperature, pressure and currents, increases the activity of the body, hardens it and in this manner causes quick reaction to atmospheric changes. Portions of the body not protected by clothing have a higher surface temperature, due to greater activity of the heat regulating apparatus.

The functioning of every organ is influenced by the air bath, which should be accompanied by exercise to increase its effect.

Cool air stimulates the nerves of the skin and increases fat combustion. Prolonged and repeated applications cause a more permanent blood flow to the surface, and relieve visceral congestion, increasing heart activity. This is shown by rise of blood pressure and slowing of the pulse, deepened respiration, increased elimination of carbondioxide, influencing the activity of the kidneys. A larger quantity of urine is excreted in winter than in summer and more on cold days than on warm days. The peristalsis of the intestines is stimulated to greater activity, and congestion of the digestive apparatus is relieved, muscular endurance and strength is improved, and by reflex, a short application has a stimulating, and a prolonged application, a soothing and quieting effect upon the nervous system.

Increased elimination and metabolism purify the blood, the air, with its temperature, pressure, saturation and currents stimulates the circulation. Pure blood and a perfect circulation are curative factors.

An air bath may be taken in any climate, in any place and at any time. We are surrounded by air, live in it, can take a dip

and an ablution as often as we wish or as often as is needed. Clothes interfere with skin breathing seriously, and it is of great importance that we facilitate this physiologic action and systematically ventilate the skin at least once or twice a day. Some people have the habit of buying a summer and winter suit and never change it except on Sunday. Some sleep in their underclothes, and wear them without change during the twenty-four hours. This is of course a dirty and injurious habit. The perspiration fills the meshes of the cloth, makes it impermeable and prevents skin breathing entirely. Toxins and bacilli are thus retained and skin diseases and serious internal diseases may be the consequences. The resistance of the organism is lowered and the individual may become the easy victim of acute infectious diseases. Sleep in a light gown, not in a suit as is the custom of some. A loose and light gown gives a better chance for skin breathing. The clothes should be changed as often as possible to free them from dust and perspiration and make them suitable for wear.

This is also necessary as regards footgear, perhaps more so. Each shoe presses on some particular spot. Corns and ingrown toe nails may be prevented by a frequent change. It is more difficult to dry shoes than it is to dry clothes and it takes more time to do so. A frequent change is economic; it saves the cloth as well as the body. Even the very poor can be taught this clean and economic habit.

The fresher and purer the air, the greater the advantage from the bath and it is of importance to select a suitable place, if a choice can be made.

An open place in the woods with a southern exposure and a view into the open landscape over hills and mountains, is especially beneficial. A simple wooden structure, provided with facilities for resting, closed to the north, east and west, keeping out rain and the direct rays of the sun is sufficient. The place must be open to the sun, which may be kept out by screens and shades, which may also be used to separate the patients. The larger the place the more agreeable the bath. Windy and moist places are not suitable.

At home, sunny rooms, galleries, porches, balconies or an enclosed garden spot, in fact, any open place that can be protected from curious eyes may be used. In the air bath we apply a great thermic stimulant with slight mechanical excitation and with little heat loss. It must always be combined with exercise.

There are but few contra-indications to the air bath. The healthy are protected, the weaklings hardened and the sick regain their health by its use.

The only exceptions are the acute infectious diseases, heart diseases with broken compensation, Bright's disease in the last stages and advanced consumption, with excessive weakness and hemorrhage. A ventilation of the skin is important for all to increase its activity, and it is possible to take the treatment in every season. Due especially to the changes in the composition of the blood, the diseases of the blood, chlorosis and the primary and secondary anaemias, are favorable for treatment. By this method chronic diseases of childhood, scrofulosis and rachitis; the constitutional diseases, such as gout, diabetes and rheumatism are benefitted. Emphysema, chronic bronchitis, bronchial asthma, pleurisy and tuberculosis are amenable to this method, with suitable breathing exercises. In heart diseases, if not too far advanced, a short cool air bath combined with exercise to be selected for each particular case is recommended. Congestions of the liver and spleen, and convalescence of all acute infectious diseases are also benefitted. It is also excellent for the chronic diseases of the intestines, hemorrhoids, the chronic diseases of the skin, like eczema, furunculosis, psoriasis, etc. The various neuroses are all favorably influenced. It is frequently an advantage to combine the air bath with the sun bath.

To prescribe the air bath rationally, it must be given with a purpose. To increase or decrease blood pressure, to direct the blood current, central or peripheral, to effect metabolism, strongly or lightly, to have an exciting, soothing or quieting effect upon the nervous system.

The bath may be given luke warm, cool or cold. The time of the day, the length of time of its application, the exercise to be combined with it, the atmospheric pressure, the degree of moisture in the air, and the air currents, all must be carefully considered, together with the character of the disease, before it can be ordered with full benefit to the patient. In our Southern climate the early morning and the late afternoon will be found well suited in most cases.

To accustom the patient to exposure, it is well to commence the bath in the room ten or fifteen minutes after rising and shortly before going to bed; upon matting or carpet, or with the feet protected by slippers. After the patient has become accustomed to this, he is directed to open the windows during the exposure, and

finally to take it altogether in the open air and entirely naked. These precautions are not necessary in the summer or with more robust patients. These may at once commence to take their bath in the open air. Gradually the time of exposure is lengthened. In a number of cases it may be continued for several hours at a time, to be gradually reduced again. On damp and foggy days the bath has to be entirely omitted, or given with great caution. Cold dry days, with snow on the ground are no contra-indications.

Every patient must be instructed to dress at once when commencing to feel chilly or uncomfortable, and continue the exercise until he feels warm and comfortable, that is till the blood is circulating well, and the skin is glowing and red.

The exercise ought to be given short of fatigue. Profuse sweating in the air bath is usually not desirable.

A warm bath followed by a cold ablution, or a douche, or the douche alone may be in many cases combined with the airbath.

The diffuse light in the air bath furnishes additional stimulation and an occasional walk into the sun, head protected by a broad brimmed hat, makes the bathing more pleasurable.

THE INFLUENCE OF LIGHT UPON LIVING ORGANISM

The vegetable kingdom is the product of light energy and this energy preserved in plants, sustains animal life.

Light, heat and chemical rays are identical except for a difference in wave length and power of refraction. Their actions upon living organisms depend on intensity, time of exposure and color as well as on the amount absorbed and on the reaction of the organism exposed. The effect is chemical and physical. Animals, vegetables and microbes stop motion and propagation and finally die when exposed to light. The effect of the direct rays of the sun is more powerful than that of diffused light, and the chemical rays have a greater bactericidal action than the other rays of the spectrum. The action of light depends largely upon the oxygen set free under its influence, which in *statu nascendi* combines with the molecules of the organism in either process of oxidation or disoxidation.

The rays of electric light have the same effect as the rays of the sun. Electric light is rich in ultra violet rays.

Light reduces the virulence of all pathogenic bacteria and finally acts as a bactericidal.

Five hours exposure to diffuse day light or one hour to the rays of the sun kills typhoid bacilli in water. The chemical rays pass unabsorbed even through sewerage. Upon this quality of light depends largely the self purification of rivers. Tubercle, cholera, diphtheria and typhoid bacilli, bacterium coli communis, the pus cocci, and other harmful organisms die under the influence of light.

Linen saturated with sputum containing tubercle bacilli can be freed from the virus in twenty-four hours by exposure to sunlight. Skin tuberculosis is cured by the rays of the sun. Furniture and clothing can be disinfected rapidly on the surfaces though prolonged exposure is necessary for a thorough disinfection at greater depth.

Light purifies the air. Tubercle bacilli and other pathogenic bacteria are killed in street dust, and cultures of tubercle bacilli die in five days at the open window.

Under the influence of light the higher plants produce chlorophyl, and light is necessary to preserve it, though if in too great an intensity it destroys it. Plants with light and chlorophyl split off the oxygen of the carbondioxide of the air, and assimilate the carbon in form of carbohydrates. The even mixture in the atmosphere of oxygen, nitrogen and carbondioxide is largely due to this process, and an enormous amount of force is stored up, upon which all other physiologic processes depend. It is the reservoir of force of the whole animal and vegetable kingdom. Plants grow in the direction of light. The stem turns towards light, becomes more turgescant and in consequence the leaf bends and grows in that direction.

Metabolism, growth and motion of plants are affected by light. The lower forms of animal life are influenced, either direct or by reflex, and everything living feels the effect of the sun.

Dark and rainy days are gloomy and depressing, decrease appetite and desire to work. The sick feel their ailments more acutely. The rheumatics are especially sensitive and their joints and muscular pains often predict atmospheric changes. The physician hears only complaints on such days and like everyone else, he longs for the rays of the sun. With the returning sunshine everything changes, and the clear and warm day, flooding the country with light and color, causes pleasurable sensations, stimulates to work, increases the appetite and draws us out into the open air, where woods and field stir with a new life and

energy. Butterflies, beetles and insects play in the sunshine, birds sing in bushes and trees. Fish splash in the water. The humming of the bees, the odor of the flowers and fruit invite us to stretch in the grass and bask in the sun. When evening comes and twilight sets in, activity calms down and darkness induces a refreshing sleep. We are daily influenced by these changes, and climate forms prominent features of temperament.

Cold and still weather is well borne by travellers in search of the Pole, but when the long Polar night commences, they become depressed and subject to disease. The absence of sunlight is severely felt and the pure, fresh air of these regions is not sufficient to preserve health. It is prolonged darkness or days without sunlight, the air saturated with moisture, that especially depresses. Slight efforts make the perspiration roll down instead of evaporating and one feels as if wrapped up in a hot, wet blanket.

The sense of perception of light in the lower animals is in the skin. In higher developed animals and in man, the eye, the organ of special sense, is the prime factor.

The skin when directly exposed to the light, that is, all portions not covered by cloth, becomes darker. Even the diffuse daylight causes pigmentation. Men frequently exposed to the direct rays of the sun show lines of demarcation on neck, forehead, arms, face and hands, which become a deep brown in contrast with the white color of the rest of the body. The immediate effect of an exposure to the sun is an inflammatory process, an acute dermatitis, an erythema solari, identical with a light burn, widening of the capillaries and emigration of leucocytes into the tissues accompanied by pain, heat, redness, and swelling takes place. This condition is commonly known as "sun burn." The electric arc light and the reflected light from the snow of polar and glacier regions has the same effect. Dark veils and ointments protect the skin. Pigmentation follows the sun burn, protecting the body against further injury. Finsen, to prove this, blackened a portion of the skin of his arm with Chinese ink, and exposed it three hours to the sun, and after removing the color found that the skin beneath was normal, whereas, the unprotected portion of the arm was affected by a severe erythema followed by a deep pigmentation. He then again exposed the arm and found the normal, formerly protected skin affected by the sunburn, whereas the pigmented portion remained unchanged.

Deposit of pigment in the skin is a chronic effect of light. The sun burn followed by pigmentation is acute. The pigment is deposited in the deepest stratum of the epidermis from the blood. Many animals whose backs are constantly exposed to the sun have this part of their bodies deeper colored, and man changes the color of his face and hands with the seasons. With the approach to the equator we find darker colored races and Europeans turn dark in the tropics and negroes living in northern climates become lighter. The nature of the pigment is the same; it varies only in quantity.

The influence of light upon the skin causes a more rapid growth of hair and horny scales in animals during the hot season of the year, and more in daytime than at night. Metabolism is directly affected. The light rays disturb the energy equilibrium of the cells. They are stimulating, but paralyze the cell plasma if too strong.

Processes of oxidation and disoxidation take place, depending on the position of the oxygen within the cell. It is split off under the influence of light and if it can form a suitable union, oxidation is the consequence, if not reduction. The more intense the light, the more rapid these chemical changes. More carbondioxide is excreted in the light than in the dark, and more oxygen is absorbed. The more intense the light the greater the elimination of carbondioxide.

It is doubted by some, that these metabolic changes are due directly to light, and thought that its psychic influence upon the nervous system, causing greater muscular tone and activity, produce these chemical changes. However that may be, the fact remains that metabolism is increased under the influence of light and experiments have shown that tissue cells reduce subnitrate of bismuth under its influence.

Light passes through the tissues of the body, which are transparent. When the hand is held before the light it appears illuminated and when with closed eyelid we look toward the sun or any other strong source of light, we perceive a bright red color. The blood absorbs the ultraviolet rays and the thicker strata absorb the green and yellow rays as well. The red rays pass through the skin cartilage and the flesh and bone.

The tissue penetrating faculty of light is least for the ultraviolet rays. Their bactericidal action extends only to a depth of 1-5 to 1-4 m.m. into the skin. Cloth and colored fabrics, especially

black, prevent their passage. Of the colors blue is, however, the least unfavorable to the passage of the rays.

Tubercular glands and bone affections have been cured by exposure to sunlight. This may be due to the hyperemia produced by the rays.

Light changes the composition of the blood, increases the haemoglobin and the number of red and white cells. The blood becomes richer in color and its specific gravity rises under its influence.

People confined in prisons and those that work at night, as well as travellers in arctic regions during the polar nights, and in the dense forests of the tropics, eventually become anaemic. The skin assumes a greenish hue.

Anaemia, chlorosis, scrofulosis and rachitis are especially favorably influenced by light.

Man needs light to keep in good health. It causes pleasurable sensations and stimulates the function of every organ, increases metabolism and cures disease. The blood that becomes rich and pure under its influence flows easily where it is needed.

THE SUN BATH

The sun bath may be given to the whole body, or partially, that is, only a part may be exposed, and certain rays of the spectrum may be applied with exclusion of others. In contradistinction to the air bath, which is never administered without exercise, the sun bath is a rest bath. The patient lies down upon a slightly inclined board covered by a blanket, or upon a mattress, a steamer chair or the like. The head is protected by a broad brimmed straw hat, an umbrella, a wooden table or a board fixed for the purpose. Cool compresses may be made to the head and large vessels of the neck if necessary. The indications for the sun bath are manifold and prompted by the effect of light and heat upon the organism. The bactericidal action of the chemical rays, the deep and penetrating action of the red and yellow rays, the dilatation of the skin capillaries, relieving congested internal organs, the metabolic changes, the effect upon the blood making organs, and changes produced in the composition of the blood, the stimulating effect upon the nervous system and upon growth, the effect upon the psyche, the profuse secretion of sweat and the excretion of toxic substances, the loss of weight, the rise of

temperature and the slight increase of pulse frequency, all have to be considered.

Many diseases are amenable to this method of treatment and but few contra-indications exist. In many instances it can be advantageously combined with the air and sand bath—the sand being heated by the sun.

All the chronic diseases of childhood are benefitted by this treatment, especially rachitis, scrofulosis, atrophy, and general weakness. The anaemias and chlorosis, gout, chronic rheumatism, catarrhs, malarial, cachexia, lead and mercurial intoxications, old syphilis, neuralgia, sciatica, tic douloureux, skin diseases, chronic eczema and psoriasis, exudations into body cavities and infiltrations, tuberculosis, (except in the last stages with hemorrhage) chronic affections of the stomach and intestines, the neuroses of these organs and many allied conditions are benefitted by this method.

Even without regulation of diet a considerable loss of body weight has been obtained, though in this, as well as in other cases, it is always best to combine several methods of treatment to produce the desired effect as rapidly as possible. Each method is but a part of the whole system of therapeutics.

In the diseases of the chest, the walls of the thorax, and not the lungs, become hyperemic, the light rays penetrate the parenchyma, and the treatment of tuberculosis, bronchial asthma, chronic bronchitis, emphysema and pleurisy by this means has given good results.

Malgot, in Nizza, has his tuberculosis patient placed at an open window with the back to the sun, protected from air current by a vest of light colorless flannel. For local applications to particular spots he uses a simplified Finsen apparatus. Maximum exposure from twenty to twenty-five minutes. He reports cessation of fever and sweat, disappearance of rales, increase of appetite and weight. The treatment has to be continued for several months. The blood pressure does not rise in a sun bath, and cases of arterio sclerosis, if not too far advanced, and the lighter cases of heart disease, may be treated with it.

Contra-indications to the sun bath are as follows:—Great debility, heart disease with broken compensation, aneurysm, advanced arterio sclerosis, tuberculosis in the last stages, internal hemorrhages of any description, states of excitation and hysteria. Neurasthenia, however, is usually greatly benefitted by this method of treatment.

The sun bath may be given like the air bath, in any climate in any season, and at any time, in any place with southern exposure open to the sun, that is private, depending solely on the position of the sun. Time of the day when best given in each particular case and the duration of the bath must be carefully judged. As a rule it will be found sufficient to administer it from fifteen minutes to one hour every second day, unless special indications call for an every day application.

The bath should never be given shortly before or after meals—it is injurious when taken with a full or an empty stomach. The patient must change his position every few minutes to expose every portion of his body to the rays. If a freer perspiration is desired and sweat excretion is slow, packing may be used to increase it. A considerable loss of weight is always obtained in this way. Duration from fifteen minutes to one-half an hour is sufficient. The sun bath is followed by a warm bath or douche, gradually cooled, except in fat patients with sound heart, when a cold douche or dip may be taken at once after the sun bath to increase fat combustion. The increase of the function of every organ, a pleasant sensation and healthy feeling of lassitude follows the sun bath. Within the house, the bath may be given at an open window, head well protected from the rays of the sun.

During the course of treatment, pulse, weight, temperature and progress must be closely watched. If the pulse becomes frequent and irregular during its administration, cold compresses to the heart must be used.

A room on the porch, or on the roof of the house fixed like a photographic gallery may be used in winter.

In case of sunburn, the bath has to be discontinued for a few days and the burns may be treated with powders or ointments.

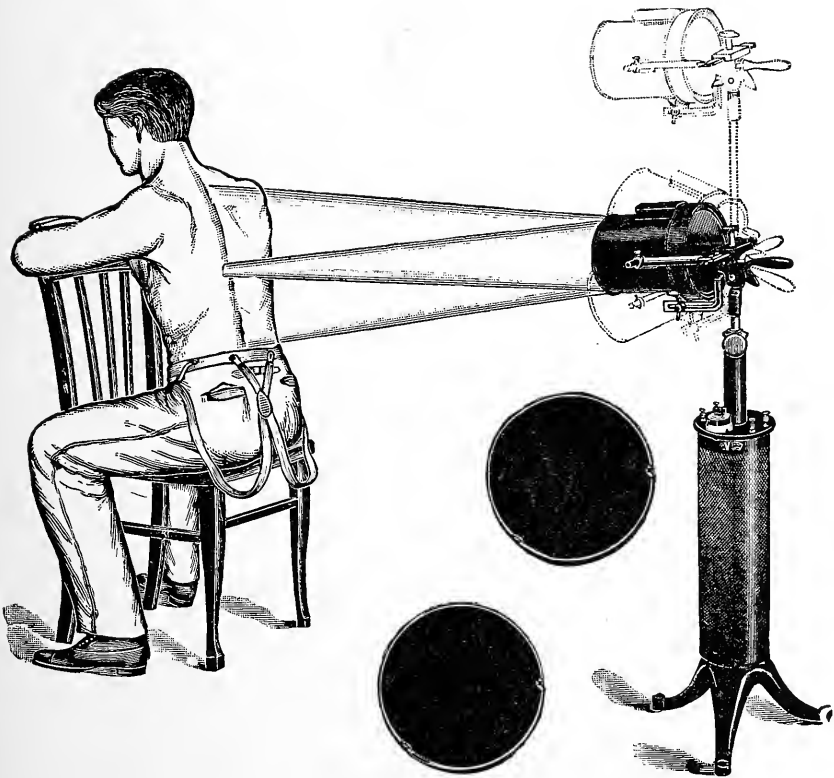


Fig. 1.

For the partial bath, electric arc light may be used instead of sunlight. This is of great importance in climates where sunshine cannot be had every day.

The partial sun bath has been used with advantage in tuberculosis, peritonitis with ascites, in joint affections, in lupus, in lymphangitis of tuberculous character, in epithelioma, in various affections of the skin and in tuberculous laryngitis, by Sörgo. He uses a common mirror with which to reflect the rays into the throat upon a laryngoscope, handled by the patient himself and claims that the method is easily learned and that it gives excellent results. His statement has been confirmed by a number of observers. Old wounds, ulcers and septic infections heal on exposure to the light. The yellow and the red rays penetrate the tissues. The ultraviolet rays act as a bactericidal on the surface.

Certain rays of the spectrum are used in the treatment of lupus, the rays are separated and freed from heat by passing the light through a system of water filled lenses.

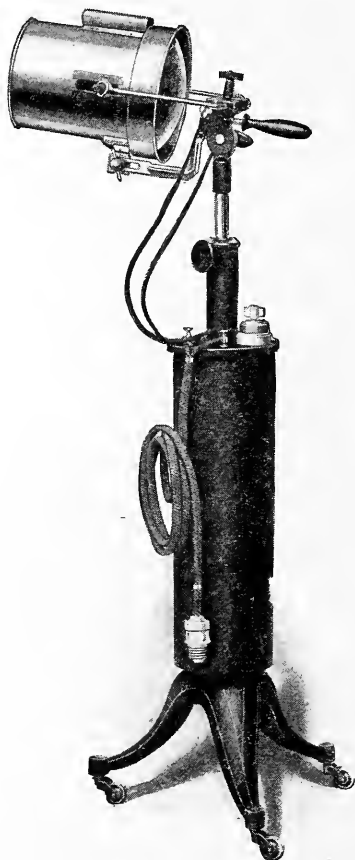


Fig. 2.

Th. Brink of Esbjerg, Denmark, believes that the benefit consumptives derive from the open air treatment, is largely due to the saturation of the atmospheric air with ultraviolet rays inhaled by the patients.

He uses a quartz mercury lamp, which emits ultraviolet rays in great multitudes, down to 180 m.m. of undulation; a box, made of sheet iron, 50 C. M. square, 20 C. M. high, with a slit at the bottom for the entrance of fresh air. In each of the four corners is made a "jutting" 10 C. M. long, 8 C. M. high and wide,

and perpendicularly on one side of the longitudinal sides of these jutties a tinned brass pipe can be stuck of 2 C. M. lumen and 20 C. M. long, so that each patient can have his own pipe. The lamp is placed in the middle of the box on a level with the bottom of the jutties, so that these can be constantly filled with rays. The position of the inhalation pipe, as it has been described, is owing to the circumstance that the patients would not be able to bear the direct rays upon the mucous membrane. Four patients at the time sit down for inhalation, and thus the volume of air in the box is consumed and renewed every minute.

The effect of ozone is eliminated by means of rarefaction of the air suitable to each patient. This is done by lighting under the bottom of each juttie an incandescent light of sixteen candle power to decompose the ozone or by allowing non-irradiated air to come into the inhalation pipe through valves.

Brink experimented especially with patients suffering from laryngeal and glandular tuberculosis in whom the healing process can be readily observed. He reports clinical cures and also excellent results in pulmonary tuberculosis. Time of inhalation three hours daily.

The red light has been largely used in the treatment of smallpox to prevent scarification, and more recently in the treatment of the examthematous diseases of childhood. In measles and scarlet fever, as well as in smallpox, the red rays dry the vesicles before pus tubes have time to form.

The various colored rays, especially the blue light has been used in the treatment of the insane to quiet maniacal patients. Blue has a quieting and depressing effect, green is an indifferent color and yellow is exciting. The patients are confined in rooms with blue colored walls and blue window curtains, and if the effect of red light is desired, red is used instead. In these cases the patient has to be protected like a photographic plate, and the curtains have to be of sufficient thickness to exclude all other rays. Experiments have shown that by this method inflammations are prevented.

It may seem strange that so many diseases of so different character can be beneficially influenced by this method of treatment, yet, when we come to consider that the *vis medicatrix naturæ* resides in the blood and the blood is purified and its distribution affected at will, we see at once a rational explanation for the striking results obtained by the influence of light and air upon disease.

CLIMATE

To select a suitable climate becomes of the greatest importance whenever a change is indicated and conditions allow us to advise it. Climate consists of various factors. Heat and cold, atmospheric pressure and moisture, sunlight and air currents and the geology and topography of the country. Mountains and sea-shore, hillside or plain, grand and rugged, or quiet and pleasant views, all influence those that live amongst them. The most important are the atmospheric conditions. Childhood is more readily influenced and benefited by climatic therapy. Children adapt themselves easily to new surroundings and are in turn moulded by them. The character of the disease and the state of the patient must guide in the selection of a climate. Enfeebled patients need rest of the whole organism and of the diseased organs as much as can be secured, at best only relative. As the patient progresses, exercise gradually has to take the place of rest to strengthen the organism and return it to the normal, or as near to the normal as possible.

As previously mentioned, man has learned to live in any climate, though he seems to prosper best in temperate zones. His hairless skin points towards the tropics as his original home, where the pigmies are found and the orangoutang and the chimpanzee still exist. The cold countries have been settled only during the last few centuries and are still sparsely inhabited. They are not congenial to man, who has to import a portion of the food he needs. Rest can be easily secured in warm climates, and exercise in colder ones. These are factors especially to be considered in selecting a climate. The weak, and those whose organs are seriously affected, need rest first of all, exercise later to strengthen.

Light cloth is worn in warm climates and heavy cloth in colder to keep comfortable when at rest. If the temperature sinks below seventy we have to increase heat production by muscular exercise or keep in artificially heated rooms. With suitable clothing and increase of exercise man can live out-of-doors in the arctic regions. On a bright and sunny day a shaded spot on a glacier feels comfortable. If rest is indicated, a temperature between 65° and 75° F. is best suited. A lower day temperature is restful only for those that can combine rest and exercise and in climates with a temperature below this. Exercise has to be directed to make it possible for the patient to spend the days out-

of-doors. Such climates are bracing, they stimulate, and the need of muscular work is felt. With this the function of every organ is increased.

The results obtained by climato-therapy depend on the methodical application of rest and exercise in the open air. This is comfortable and only possible in climates with an average humidity not too high. An atmosphere saturated with moisture bars evaporation and this becomes more effective as the moisture in the air becomes less. It depends, however, on temperature. At low temperature, perspiration is nominal, and atmospheric humidity does not seriously interfere with health, though even then it is not comfortable. At 55° F. and upward it becomes more and more perceptible and finally dangerous to life. An air saturated with moisture may cause heat stroke at body temperature. Even intense heat is not injurious as long as the air is dry. People feel depressed in such a climate, and the days are sultry that combine high temperature and humidity. A sudden rise in temperature is less felt than a sudden fall, and such a drop is dangerous to the aged and the feeble. It taxes the organism severely, especially the circulatory apparatus, to adjust itself to the change, especially when the fall is rapidly followed by a rise. Continually clouded skies found in humid regions depress, and continually rainy days irritate. A climate that offers changes of these conditions is the most desirable. Occasional cloudy weather has a sedative effect, and bright and sunny days stimulate. Rainy days interfere with out-door life, but occasional rains cool the air and purify it. Continued snow in winter favors out-door sports and bright and sunny days with snow on the ground and ice on lake and river stimulate and invite one to spend the day in the open air. Cool and refreshing breezes are essential to a good summer climate. They refresh and purify the air, and have a similar effect as summer rains. High winds and storms are injurious, and invalids must avoid regions where they are frequent.

The daily variations of atmospheric pressure are of but little consequence, whereas the variations due to altitude are of importance. The moving from a lower to a higher altitude means breathing of rarified air, and the removal from a mountainous country to the seashore means to breathe compressed air. At an altitude of five thousand feet at a temperature of 32 C. one breathes a volume of air one-sixth less than at sea level. The amount of air pressure at sea level is fifteen pounds to the square

inch, and diminishes at the rate of one pound for every thousand feet. This necessitates a greater expansion of the lungs to supply the want of oxygen.

Breathing becomes deeper and more rapid on changing from a lower to a higher altitude. It becomes gradually less frequent, but remains deep if the altitude is not too great. This differs with each individual case. The change in the character of breathing is accompanied by increased heart work, the blood flows with greater rapidity through the vessels and is more thoroughly aerated. At the same time an enormous increase of red cells is noticed, which increase with the altitude, and has been found to amount to about 1,000,000 at an altitude of 2,500 feet.

Metabolic changes are increased in proportion, and vigor and strength of the whole organism is the consequence. If high altitudes are needed, it is better to direct a slow ascent, as a sudden change may lead to serious trouble, over-stimulation and over-work of every organ.

Temperature variations change with the topographic features of the country. It is lower on high and isolated peaks, due to loss by radiation, and radiation is greater on high plateaus than on low plains, on account of the rarified air. The difference of temperature in high altitudes between seasons is less than at lower levels, and in rugged mountain regions the valleys are cool and the mountain sides warm and should, therefore, be selected for residence.

The value of high altitudes for consumptives has been long recognized, and it is especially with reference to this disease that its influence upon organism has been studied.

The breathing of perfectly pure, dry and cool mountain air stimulates respiration, increases heart work, changes the composition of the blood, increases metabolism, and invigorates and strengthens the body.

Easily irritated and highly excitable patients are usually not suited for a treatment in the mountains. The rarified air not rarely causes insomnia and increases excitability. On the other hand, the phlegmatic and languid are stimulated, though this rule does not hold good for all cases especially if care is taken in finding an altitude suited to each particular case. Hill and mountain climbing strengthen heart and vessels, but those that suffer from diseases of the circulatory system must be carefully watched, the territory well selected and their daily exercises guided by the

physician. Long gradual slopes are best adapted for the treatment of heart disease.

Warm climates are restful, and often indicated for patients of colder countries. The tropics are not suited for climato-therapy. Hot climates are enervating, that is countries with an average temperature about 70° F. Cool climates are useful for all except those that are very much enfeebled and need constant rest. The same may be said of a medium altitude from 1,500 to 3,000 feet, which is good for all except the seriously ill.

The countries bordering the ocean have humid climates and usually more cloudy and rainy days than those in the interior. The temperature is always modified by the presence of large bodies of water. Ocean air contains salt in minute quantities. A desert climate is dry and its average humidity below 40° F.

Seasons influence the climate in every feature and it may become necessary to have a patient change his residence with the seasons to secure the benefit of sunshine, dryness and altitude in a particular case. Only a constant out-door life will give the full benefit of this method of treatment and the residence should be well selected to secure sunshine, the greatest and most needed stimulant for the sick.

In selecting a climate we have not alone to study the climatic features, but the accommodations that can be had, as well. For some, prevailing primitive conditions may be of advantage, whereas for others, all the modern accommodations of life may be needed to make them comfortable. A patient must like his surroundings if he is to derive the greatest benefit of the change. If he stays because he has been told to do so, and if he remains in spite of feeling uncomfortable, everything disagreeable to him, in bad humor from morning till night, he is far better off at home. Only when he can establish himself as in a second home and his surroundings are cheering and inspiring can we hope for recovery. This is a factor often overlooked, and it is well to tell patients not to stay if they do not like it, but to try another change and if they cannot be suited, to return.

The extreme North has been recently recommended as a suitable climate for consumptives on account of the good results obtained during the winter months in temperate regions. However, only a few, if any, will find it of advantage to go there in search of health. The journey is long and usually stormy and the dampness of the atmosphere makes the summer months unpleasant and felt more than the intense dry cold of the arctic

winter. Eastern Canada and New Foundland have favorable climatic conditions in August and September. The spring is foggy and the late fall has storms and rains. A large number of Southerners select Eastern Canada, and praise it highly as a cool and bracing summer climate, notwithstanding the foggy days they often encounter in June and July.

The coast of Maine is a favored resort. The climate is usually bright and cool, and its southern portion warmer. The accommodations are good and it fully deserves its reputation as a health resort. Vermont and New Hampshire have a large number of well established places, with a cool summer climate, neither too wet nor too dry and suitable altitudes may be found in the mountain regions.

The Adirondacks are a favored resort of New Yorkers, and consumptives may be found scattered all over this country on account of the vicinity to the city. The summer climate is cool and bracing, but care has to be taken in selecting a residence on account of the exposure to consumption. This, however, has to be done wherever we go. Consumption is always with us, and to find it we do not need to leave home. Protective measures are well known, sanitation is usually enforced and makes it safer to travel. Good accommodations can often be had miles away from the railroad, with the advantage of assured rest and quiet.

Along the St. Lawrence and Hudson, accommodations can be secured almost anywhere, and Saratoga Springs has become a very fashionable resort—too fashionable to be of much benefit to invalids.

The Catskill Mountains offer climate and facilities similar to the Adirondacks, and they are easily reached.

Several places along the New Jersey coast have made a reputation. Atlantic City is the best known resort. The summer is agreeably cool, though occasional hot days and foggy nights may make the stay unpleasant. The winter climate is cold, but has clear and sunny days almost throughout the season.

A number of good health resorts are found along the Lakes, but are useful only during the summer.

The Thousand Islands are much frequented. They have good accommodations and are agreeable in not too warm a summer. Lake Chautauqua, Mount Clemens; a number of places along the shores of Lake Michigan and Waukesha, are well known and offer a pleasant and cool summer climate.

In the mountains of Virginia and in the Carolinas, many places may be found suited for climato-therapy, and quite a number have a national reputation. Hot Springs and White Sulphur Springs of Virginia, Crocket Springs and Mountain Lake, with 5,000 feet elevation, Asheville and Hot Springs, North Carolina, with an altitude of 1,900 and 1,300 feet, Lookout Mountain near Chattanooga, Tenn., with an elevation of 2,130 feet are all good summer resorts.

A medium altitude, a cool spring and fall with a summer not too hot, attractive mountain scenery, good accommodations, easily accessible from the South and North can be used with great advantage for the sick.

Here, like elsewhere, the health resorts are frequented by consumptives and proper precaution should be taken in selecting a residence. In the South and Southwest we find many places suited for climatic treatment in the winter. Savannah has an average winter temperature much like Southern California. Jacksonville, St. Augustine and Pensacola have a sub-tropical climate. A little cooler is the climate of Mobile and New Orleans. The climate of New Orleans is almost ideal in the fall and spring, that is from the middle of October to the end of December, and from February to the beginning of May. The balance of the year is either too cold and rainy, or too hot. The winter months, January and February are the height of the gay season and, therefore, not well suited for the treatment of the sick. New Orleans is built on a village style, the houses are small and seldom over two stories high with a few skyscrapers in the business center. The city covers an immense territory, the streets are usually wide and the houses are surrounded by lawns. The sanitary conditions are good, that is the city is provided with good drinking water, has sewerage and drainage, and has a number of health resorts within easy reach—Covington, Abita Springs, Browns Wells, across Lake Ponchartrain. New Orleans combines **the advantages of village and city** on account of its construction. Being well ventilated, sunstrokes and prostrations even in the hottest and most sultry days are practically unknown. Almost every family lives in its own home and it would be a pity to have these healthy conditions changed by the introduction of skyscrapers, flats and large tenement houses, the ambition of every country town. Pass Christian, Bay St. Louis, Biloxi, and many other places along the coast offer good accommodations.

The winter months are not suited in any of the Southern places mentioned on account of the sudden changes caused by the north winds that sweep down the Mississippi Valley. Florida has similar advantages and disadvantages.

The great western plains are less recommended now than they were formerly. The intense dryness, the dust storms in the summer and blizzards in the winter, the monotony of the prairies, offer but few attractions, though the sunny days and the cool nights in summer with clear skies and pure rarefied air, make them useful at times. Especially for those that are strong enough to spend at least a portion of the day on horseback, such a ride on a western pony over the wide open prairie with nothing to obstruct an immense view, with here and there a mirage in the distance, is exhilarating. Camp life and the sleeping in the open air is stimulating and hardening. Weaklings ought not to be sent to the plains.

Any altitude and almost any climate may be found in the Rocky Mountains. In Canada and Wyoming the climate in summer is cold. Colorado, Denver, Manitou and Colorado Springs, and especially Estes Park, are favored resorts with excellent accommodations. The days are clear and rather warm, but the nights are cool, the atmosphere is dry with some humidity in the spring. Yellowstone Park is cold, and is open only in the summer.

New Mexico attracts many. It has a dry atmosphere the year round, plenty of sunshine and showers to cool. Sante Fe is best known in that region. El Paso has the climate of the plains. Phoenix, Arizona, has the best dry and warm winter climate known, the temperature resembling that of Jacksonville, Florida, without its sudden changes. The summer is too hot to be beneficial.

Southern California has the best climate on the Continent. Los Angeles, with its suburbs and resorts has been the Mecca of health seekers for years. However, the morning and night fogs, changing very suddenly with the heat of the day are not favorable and the places in the mountains above the fogs are preferable. It is a perfect winter climate and the sunny days allow an almost constant life in the open air. Monterey and Santa Cruz are not inferior to Los Angeles. The best season is the winter. Northern California is rainy and stormy in the winter and damp in summer. The climate is disagreeable the year round.

The interior of Oregon and Washington has a fine summer climate. It is dry, yet not too dry, with warm days and cold nights.

Space only allows mentioning the places that are best suited for climato-therapy. More extensive data can easily be secured in larger works on this subject, and by application to the various resorts.

So enormous was the travel to Europe in search of health and suitable climatic conditions before the war, that a short sketch of health resorts will be found appropriate.

It is not alone the climate that makes people cross the Atlantic, but the far superior accommodations that are found and that can be secured at any price, together with the history of past centuries recorded in brick and marble almost in every little town and hamlet, which attract the American and let him soon forget the inconveniences of ocean travel. Even this is enjoyed by most people, if not too seriously ill. Much depends on the season when such a sea trip is undertaken. From the Middle of May to the beginning of October the Atlantic is at its best. The big ocean liners are veritable palaces and the outside cabins, high enough above the water line to permit the opening of windows during rough weather, secure fresh air during the night. The day is spent on deck, and resting in a comfortable steamer chair, wrapped up in rugs and blankets, with waterbags applied to feet and stomach if needed to keep warm. The face is fanned by the pure fresh sea breeze and the meals may be taken on deck. The patient finds play and company if he looks for it and can be alone or in a crowd if he wishes. A particular diet can be secured and the medical service is usually good. The great advantage over extended railroad travel is the air, comfort and safety. In a large number of trips usually taken in May and October, I do not remember a day I had to spend below deck. On the fast liners the trip amounts to but a few days and the time passes quickly enough. Everybody seems to be in good humor. The trip to Mediterranean ports is longer, but the seas steadier and the weather usually clearer. The sick are advised to engage their passage months ahead of time, in order to secure a room midship, south side and promenade or upper deck outside. If they wish to change places such a cabin is readily sold even fourteen days before sailing. Seasickness interferes but little, though a few remain sick from the beginning to the end of the voyage. Most people get well after a day or two and remain so during the rest

of the voyage. Long sea trips are still prescribed to secure fresh air and rest. If this is done, special care must be taken to select the line and the ship, and it is well to find out beforehand whether the patient does not belong to that class of people that are seasick and remain so during the whole trip. Europe offers a great variety of climates and resorts that have established a reputation during past centuries.

Norway and Sweden are known to tourists. The mountain scenery is grand and the climate cool and bracing.

England has much frequented resorts, of which Brighton is one of the best known. The English climate of the interior and the eastern portion is changeable, that of the west and south even and uniformly warm, though like the rest of England, it has but little sunshine. Fogs are common and storms are frequent and London fogs are known to everybody who has passed any length of time in that city. The summer months are the most favorable. During that time the weather is usually quiet and less foggy in the British Islands.

Germany has a large number of very fine health resorts along the Baltic, on the northeast, in the central and southern portion of the country. The middle mountains resembles the mountains of Virginia and the Carolinas. They are low ranges with an occasional elevation to 5,000 feet. The health resorts are usually located at some spring and the waters of Ems, Nauheim, Oynhausen, Elster, Reichenbach and many others have become famous for their virtue. On the North Sea, Sylt and Heligoland attract many, though most of the Germans prefer the Baltic. Heringsdorf, Reugen and Wollin are beautiful little islands off the coast.

The Germans like to roam and everybody who can afford it takes a vacation in mountains and woods during the hot summer months. At the end of July when school closes it seems that the city population emigrates to the country. Boys and girls, men and women, tramp singing through mountains and forest. Nearly all of the mountains are well wooded; Thuringen and Harz, Schwartzwald, Riesengebirge, etc. Everybody enjoys the pure air, the pleasant walk, healthy exercise and simple fare, away from the path that is followed by the fashionable. They, too, find in the famous resorts, pure air, parks and drives and do not miss the luxuries of homes they left.

Goebersdorf in Silesia has to be mentioned where Brehm first showed that the open air treatment at higher altitudes was one of the best means to cure consumption.

The Riesengebirgs region is especially attractive to the Germans from the northern country; it is here that Hauptmann wrote and a little colony of artists has settled. It is more primitive than most of the other mountain ranges and I have spent many a pleasant week in Giersdorf, a little village at the foot of the mountain chain.

Bohemia, bordering on Silesia, has famous resorts. Carlsbad, Marienbad, Teplitz and others with a climate similar to that of central and southern Germany.

France has a warmer climate than Germany and the south is sunny. The well known springs of Vichy are centrally located. It has many resorts on the coast of Normandy. In the Vosges and the Pyrnees, Aixles Bains with Sulphur Springs, Chamonix in the Alps with an elevation of 3,400 feet.

The Alps are the stamping ground of tourists of both Continents, and excellent accommodations can be secured everywhere. The climate of their northern slope is the same as that of southern Germany.

Davos and St. Moritz with an elevation of 5,000 feet in the high Alps, have made a reputation for the treatment of consumptives. The climate is cold and bracing and it is well suited for the purpose of hardening. The southern slope of the Alps, sheltered against the north by high mountain chains is warmer than Northern Italy. It possesses at once the most excellent summer and winter climate. The weather is even, and sudden changes are entirely unknown.

Montreaux in Switzerland, Bozen, Meran and Riva on the blue waters of the Lago de Garda, in Tyrol, and the whole beautiful country between these, offer facilities of travel and have accommodations entirely unknown on our Continent.

Along the Mediterranean the Riviera, with Genoa in the center, is probably the most famous strip of country in all the world and might be well called its meeting place. The average temperature ranges between 40 and 80° F. the year round, with a gradual rise from June to July and a gradual fall to January. Especially the central portion is sheltered by the Alps and the Appenines and the hot south winds blowing over the African Desert are tempered and cooled by the Mediterranean before they reach the shores of Italy and Spain. As we advance from the

Riviera southward, the climate becomes warmer with the exception of Lombardy. Milan and Venice are colder than Genoa. Further south from Rome, Florence, Palermo, and Naples the temperature rises proportionately, though the difference is not great. Palermo is beautifully located and its bay almost rivals that of Naples. Accommodations are more primitive in Sicily, but the beauty and climate of the country will make up for deficiencies.

In Spain, Granada, Valencia and Murcia rank high as to climatic conditions, but the accommodations are not superior to those of Sicily. Greece and Turkey do not come in question as health resorts, they are frequented by tourists.

A number of fine winter climates are found on the African coast. Algiers with Biskra at the edge of the Sahara and Egypt with Cairo, dry and warm, are well known.

All that has been said regarding the indication of fresh air, the air bath, the light bath in disease applies to climato-therapy. Only when the climate for the patient is well selected can the greatest benefit be derived from these methods.

Sun bath becomes almost useless in a climate with little sunshine, and an air bath is dangerous in cold and damp climates and can be used only with great caution. To give general rules is impossible. Too much depends on the financial condition of the patient, the character of the disease, his general condition, the season of the year, the age and other factors. There is hardly any chronic disease that can not be favorably influenced by climato-therapy, and the few contra-indications that exist have been pointed out on the previous pages. It is the atmosphere with all its qualities that are used as therapeutic agents to produce pure blood and a normal circulation. The climate has to be selected to save the organs from excessive work, protect the organism by rest and strengthen it by moderate and gradually increased exercise.

CHAPTER III

DIET

A diet is made up of meat, lean and fat, milk and eggs, vegetables and fruit, sugars and starches—that is, bread and cereals. This is the food best suited to man; he has become adapted to it through countless generations and the anatomy of his digestive system indicates it. Hard food, which has to be thoroughly chewed before it can be swallowed, keeps the mouth clean, though the tooth brush, tooth powder and mouth wash are necessary on account of the preparation of the food and ought to be used freely after each meal.

Food furnishes the means to make blood, and we can suit it to age, occupation and to any disease under any climatic conditions.

Selection of a suitable diet depends on climate and season, age, personal taste and habit, changing widely with social conditions and country, and on the activity of certain glands that preside over metabolism. A clear distinction has to be made between foods that are digested in the stomach, and others that are digested in the intestines. Some foods are brought with difficulty in solution by the gastric juice, when the intestinal juices will dissolve them with ease, and vice-versa. An increased or decreased gastro-intestinal secretion, absorption or motility, may disturb it.

Digestion commences in the mouth, and thorough chewing and insalivation are necessary; the stomach has no teeth.

Excitement, grief and worry may cause pain and nausea. Cheerful company aids digestion and the beneficial influence of rest after a meal is known. The digestion of food depends largely on the quantity ingested and on its preparation. Some foods are easier digested in the morning and others at night. A digestible food ought to be easily dissolved by the action of the gastro-intestinal juices; it ought not to slow or increase gastro-intestinal peristalsis unduly; it should not irritate the mucus membranes, chemically, thermic or mechanically, and should be readily absorbed.

All foods consist of water, proteins, fats, carbohydrates and salts, and the percentage of water ranges from 10° to 98°. The

nutritive value depends on their chemical composition and the amount that can be absorbed during their passage through the gastro-intestinal tract.

Though water is an important part of our diet, foods that contain much of it are considered of less nutritive value. Albuminous foods, on account of their contents of nitrogen, are of importance; a diet without them is insufficient.

Meats contain from 17% to 25% proteins. Cheese 25% to 35% and the legumens 25%.

The carbohydrates, the starches and sugars are mostly found in plants. Wheat bread contains 55%, potatoes 20% and sugar 95% of carbohydrates. Fats are derived from animals and plants. Butter and cream, meat fat and olive oil are all in daily use.

Of the salts the most important is table salt, as a condiment and as a necessary component of the body. Nutritive salts are iron, phosphorus, sodium, potassium, calcium, etc. From 1% to 3% are taken with every meal.

Foods, after they have been absorbed by the cells, are burnt up and produce heat and energy, and the heat unit, the calory, has been adopted to judge the nutritive value.

1 gram of albumem	equal to 4.1	} Calories
1 gram of carbohydrates	equal to 4.1	
1 gram of fat	equal to 9.3	
1 gram of alcohol	equal to 7.0	

0.244 gram of albumen or carbohydrates	} Furnishes one Calory
0.102 gram of fat	
0.143 gram of alcohol	

It is this proportion in which the different food-stuffs can replace each other to some extent.

We can calculate the value of foods if their composition and the quantity absorbed during their passage through the gastro-intestinal tract is known. The amount ingested, minus the amount of albumen, carbohydrates and fats contained in the fecal matter, is the balance digested. The undigested matter consists mainly of insoluble cellulose and similar substances.

The healthy organism is capable of absorbing 93% to 95% of the protein of meat, 60% to 80% of vegetable protein, light bread and rice up to 1%, carbohydrates of beans 70%, and fats melting at body temperature, if not ingested in too large quantities, are absorbed almost without loss. Variety as well as a good mixture of the various food-stuffs facilitate digestion and absorp-

tion. One part of protein to three and one-half—four and one-half parts of fats and carbohydrates furnish the best mixture.

Foods are judged by their nutritive value and digestibility. The daily amount of food necessary for an individual to keep in good health varies according to age, sex, height, weight and work, under the same climatic conditions. Adolescents need more than adults; they have to provide for daily expenditure, as well as for growth. The body weight gives a fair idea as to nutrition; it must correspond to height. The height in centimeters above the meter should be the number of kilograms bodyweight, a person measuring one hundred seventy centimeters should weigh seventy kilos.

The weight tends in middle life to increase with age, so that about $\frac{3}{4}$ lbs. should be deducted for each year under thirty and added for each year above 30:

AVERAGE WEIGHT FOR HEIGHT OF A MAN OF THIRTY, DRESSED.

Height Ft. In.	Weight Pounds	Chest Cir- cumference Inches	Height Ft. In.	Weight Pounds	Chest Cir- cumference Inches
5 0	112	33½	5 7	148	38
5 1	116	34	5 8	155	38½
5 2	126	35	5 9	162	39
5 3	133	35	5 10	169	39½
5 4	139	36	5 11	174	40
5 5	142	37	6 0	178	40½
5 6	145	37½	6 1	182	41

The average weight of the clothing is 1-24th that of the male body.

AVERAGE WEIGHT FOR HEIGHT OF A WOMAN, DRESSED.

Height Ft. In.	Weight Pounds	Height Ft. In.	Weight Pounds	Height Ft. In.	Weight Pounds
4 10	98	5 2	114	5 6	139
4 11	102	5 3	121	5 7	148
5 0	105	5 4	128	5 8	158
5 1	110	5 5	135		

The average weight of the clothing is approximately 1-20th that of the body. Up to about 5 ft. 7 in. will be seen that women tend to weigh less for their height than men. Above this height they weigh usually as much or more, and in late middle life not uncommonly very much more.

The amount of water needed depends on the factors mentioned. A large quantity is contained in the solids and semi-solids. Ingestion of large amounts of liquids dilute the gastric juice and may cause dilatation of the stomach. Pieces of food

may be swallowed unchewed, when liquids are taken with the meal. If patients can eat better and with greater relish, small amounts of liquids may be allowed.

The temperature of the foods is of importance and not enough can be said against the ingestion of iced liquids, though foods taken too hot may cause injury to the mucus membrane of the esophagus and stomach. Water is not absorbed in the stomach, and may be given by rectal injection as normal salt solution, if for some reason only small amounts are permissible by mouth.

Water like all foods should be pure, and aerated waters should be taken in small quantities only; they distend stomach and intestines.

Though milk contains all the principles of food and is theoretically ideal, it contains too much water, that is, too large a quantity is needed, if it is alone depended upon. It may be enriched by condensation or by adding cream, eggs and other foods. The taste may be altered and digestibility enhanced, curdling prevented by a small addition of cocoa, coffee, tea or lime water.

Milk contains	3.5%	Albumen
	3.8%	Fat
	4.8%	Carbohydrates and Sugar
	0.7%	Salts
	87.4%	Water

Buttermilk, on account of its agreeable taste, ready absorption and mild purgative action, is a valuable article of diet in the sickroom.

Clabber is more easily digested than milk; it contains fat, has an agreeable taste, and the uncomfortable feeling it causes some persons may be prevented by beating it up.

Kefir is fermented cow's milk and contains protein and carbohydrates in an easily digestible form. The small amount of alcohol it contains stimulates gastric secretions. It acts as a purgative when one day old, and causes constipation when three days old, changing with the diminution of ferments and increase of lactic acid. Coffee and tea are pure aromatics. Cocoa and chocolate possess nutritive value. The active principles of coffee, tea and cocoa are caffein, theine and theobromin. Cocoa differs from chocolate; it is defatted, and has no addition of condiments or flour, or sugar.

Alcohol is largely absorbed in the stomach and if taken before eating increases the flow of gastric juice; larger doses decrease it. Unfermented wines, if not sterilized, are injurious on account of the yeast cells they contain, which cause fermentation and disturb digestion. Alcohol, if taken in larger quantities in any form, or if continuously taken in smaller quantities, is injurious and especially when taken before eating. Alcoholic beverages containing tannic acid, like huckleberry wine and the Greek wines may be used in intestinal diseases.

Champagne contains carbondioxide and produces a rapid stimulating effect; it is frequently given in infectious diseases.

Beer as a rule is not useful in disease; it contains yeast cells. Malt beer is richer in carbohydrates and frequently prescribed.

Eggs are of great nutritive value; their digestibility depends on the manner of preparation. Raw eggs, soft boiled eggs and poached eggs are easily digested. Hard boiled eggs more easily digested if powdered.

Fat meats are less well digested than lean meats; fat prevents the gastric juices from coming in close contact with the meat particles. White meats are tender and contain little fat and extractives. Raw meat scraped is easily digested, dangerous, however, on account of parasites it may contain. Cooking and frying deprives the meat of a considerable amount of water and makes it, therefore, more nutritious. Smoked meats have to be used with caution; permitted only as appetizers. Meat of the lean fish is easily digested and nutritious. Fat fish must be avoided in diseases of the stomach. Oysters possess little nutritive value; they are refreshing and appetizing.

Bouillon and clear meat soups have practically no food value but may be enriched with yolk of eggs, cereals, etc. Meat soups may be given in small quantities as appetizers, if not contraindicated on account of their content of salt, pepper, spices and extractives. Meat juice is somewhat richer, and many artificial meat solutions and peptones may be used instead. Their value consists mainly in their quality to stimulate the appetite.

Of greater importance are preparations produced from milk. All may be used alone or in combination as substitutes of the natural diet.

Of the fats, butter and cream are the best; meat fats are enclosed in insoluble fibrous tissues. Cream is best boiled before using it as addition to cocoa, milk, coffee, fruit, etc.

Cheese is rich in nutritive value, and if not contra-indicated, is best given grated; it requires a thorough chewing.

A thorough insalvation of the carbohydrates is necessary; the process of their digestion commences in the mouth. Crusts of bread, stale bread and toast are easier to mix with the saliva than the soft parts of hot, fresh breads, and, therefore, preferable.

Wheat is to a larger percentage absorbed in its passage through the digestive tract than other foods.

The cereals may be added to soups. Barley soup is a home remedy in gastro-intestinal troubles. The legumens have a large percent. of albumen, with fifty percent. of carbohydrates; they require a thorough preparation and long cooking. The flour of beans, peas and lentils, free from hulls, is easier to prepare.

The potato, and especially the Irish potato, is a daily article of diet with most people. It is not of great nutritive value and is difficult to digest, unless prepared as puree, mashed with butter and milk, which enhances its value and makes it more digestible. The baked potato is also easier digested than the boiled potato, better done and easier to chew.

Carrots have less nutritive value than potatoes; they are of importance with the green vegetables in cases of atonic constipation to excite intestinal peristalsis. People with digestive troubles have to take them in form of puree.

Salads, like lettuce and cress, are best prepared with lemon juice. Vinegar contains yeast cells. Raw vegetables and fruits are necessary, probably due to the contents of vitamins. Some of them are partly destroyed by cooking. Babies fed on boiled milk become susceptible to scurvy, which can be corrected by adding orange juice.

Fruit contains a large amount of pure water—between 80% to 90%—and some sugar. Stewed fruits are easier digested and less irritating to the mucus membranes on account of the softer condition of the cellulose, and if given as purees, may be used in gastro-intestinal diseases.

Raw fruits are useful in cachetic conditions, and the fruit juices freshly pressed, are refreshing and useful in these as well as in febrile diseases.

All fruits, especially prunes, act on the intestines, and in chronic constipation, prunes are a standard home remedy. In catarrhal conditions, they should be given freshly prepared as puree.

The sugars are of large caloric value, daily used, and sugar of milk acts as a mild laxative.

The condiments are appetizers; the most important is the table salt.

Casimir Funk has shown that besides the proximate principles in food; proteids, carbohydrates, fats, water and inorganic salts, to which the value of our food is due, a number of substances can be found in small quantities, which are as indispensable to life, as the former constituents. He has called these substances vitamins. He was inspired to search for them by the work of Erykman, Grigns and Schauman, who were able to prove that in rice polishing and in yeast, substances are present which protect fowls, pigeons and men against beri beri. Vitamins belong to the group of inorganic nitrogenous bases.

With reference to the action of the vitamins in the tissues, nothing definite is known, except that they bear a certain relation to carbohydrate metabolism. If a pigeon is fed on polished rice, it is possible to tell approximately when the symptoms of beri beri will appear, when a given quantity of rice is metabolized.

It is also found that the blood sugar content in avian beri beri is generally increased. This fact has a practical bearing on infant feeding; a certain amount of vitamins can take care of only a limited amount of carbohydrate, and when starch is increased in the diet, the amount of vitamin containing foodstuffs must be increased in proportion.

A second fact has been established in connection with the metabolism in the deficiency diseases, which is, that in the absence of vitamins, we not only obtain a negative nitrogen balance, but the whole metabolism goes wrong; that is particularly noticed in the negative balance of inorganic constituents. The addition of vitamins puts the whole metabolism again on a normal basis. Vitamin when properly prepared and added to the diet of polished rice makes that diet complete. He has also shown that no animal has yet been found able to live more than a short time on vitamin-free food.

It is probable that the lack of vitamins in a diet free of vegetables, raw and cooked, and of fruit, causes the deficiency disease—"Beri beri, Pellegra, Rickets, Scurvy", and that a diet with a liberal supply cures them and influences favorably cachaxias.

Carl Voegtlin and C. M. Myers state that highly milled products, (wheat flour, cornmeal, cornflour and grits) obtained

by the roller process, are superior to the oldfashioned whole wheat and cornmeal, so far as the keeping qualities are concerned, but that the modern process deprives the finished products of some valuable constituents. They contain less protein, fat, inorganic salts and vitamins, than the oldfashioned products.

These substances are located in the intact kernel in the outer layers (aleurone layers) and probably in the germ.

They also state that bread made with soda is deficient in vitamins. Alkalis and heat destroy them and sodium carbonate, a strong alkali, is the result of the baking process.

These observers believe that this bears on the pellagra question. Little has reported an outbreak of beri beri among the fishermen of Newfoundland, who lived mainly on bread made of highly milled flours.

DIET IN DISEASE

We have to make a difference between the febrile diseases of short and long duration. The object of the dietary regimen is to keep the patient in as good a state of nutrition as is possible, to keep the blood pure and to influence the circulation. All febrile diseases cause waste, due to loss of appetite and the toxic condition that prevails. The loss of body protein is in proportion to that of fat, in fact it is greater, contrary to the common belief, and it is of great importance to consider this in dietary measures. In febrile diseases of short duration, diet is a negligible factor, though of importance during convalescence. On the other hand, it deserves the greatest consideration in chronic diseases. Experience has taught that a diet rich in carbohydrates and nitrogenous foods in these diseases, especially in consumption, increases resistance and strength of the patient, and it is known that the anti-bodies are protein substances, derived from the body protein, which has to be replaced by food.

During the febrile process, large amounts of liquids are indicated to dilute the blood, make it less toxic and less irritating, especially in diseases in which the kidneys are liable to become affected, such as Scarlet Fever, Diphtheria, Pneumonia, and others. It is a time to "Save the Kidneys". For the same reason, all irritating substances, condiments, pepper and salt must be used sparingly. Coffee, tea and alcohol in some form may be given as heart tonics, in selected cases. It would be unwise to withdraw

alcohol from a patient who has always been accustomed to its use, or not to give it in protracted cases when the patient craves it, and when it will serve as a good appetizer and stimulant. It is usually not difficult to give a sufficient amount of liquid to patients who have lost their appetite for solids and are exceedingly thirsty. Food is administered in liquid form, the medicine diluted with water, and fruit juice added to allay thirst. Occasionally, patients will object to larger quantities of liquids, and in these cases it may be given as a nutrient enema, and if larger quantities are needed, by enteroclysis, in the form of physiologic salt solution. When the kidneys are affected, the salt must be replaced by sugar of milk. Color and quantity of urine voided per twenty-four hours indicate the amount of liquid to be given.

Milk is an excellent food in febrile diseases and very largely used, often to the exclusion of all other foods. If the disease is of long duration, however, it becomes too monotonous and lessens the appetite. As a rule, it is well liked and we do not find patients that will object to milk in some form. It is easily digested, non-irritating and can be given in many different ways,—iced, as milkgelee or buttermilk. Coffee, tea, cocoa, vichy and lime water may be added to overcome aversion to odor and taste. It may be enriched by boiling down, adding yolk of eggs, cream and butter. Serve it in the form of soups and flavor to suit the taste. A further advantage is that the patient, in order to get the necessary amount of calories, has to take at least two quarts per twenty-four hours.

Beef tea, freshly pressed fruit juices, and the meat extracts, like Valentines' beef juices, Armour's Extract, and the like, are favored articles of diet during fevers. It must be borne in mind, that though excellent appetizers and stimulants to the heart and nervous system, they have practically no value as foods; they, however, may be enriched with yolk of egg, egg albumen and cereals.

If the meat extracts are contra-indicated, fruit and wine soups may be given, with eggs and cereals added to increase their value. They are refreshing and usually liked by the patient.

Eggs may be further given, such as white of egg in water, egg and sherry, yolk of egg with claret and sugar, egg beaten up to foam with orange juice, apple butter, etc.

The various meat, fruit, wine and milk jellies furnish a valuable addition to vary the fever diet. They do not tax the digestive organs and are cooling and refreshing.

If it becomes necessary to give a diet rich in calories, as is the case in chronic infectious diseases, the fever itself offers fortunately less contra-indication, to a partly semi-solid and solid diet—and overfeeding, frequently indicated in tuberculosis, becomes easier with an increase in the variety of the food that can be given.

Meals are best served when the temperature is lowest. The appetite and the faculty to digest the food decreases with increasing temperature. Meat should be tender and served in a form to excite the appetite. Chicken, bird and fish are tender meats, and may be prepared in a great variety of ways.

Crackers and toast softened in milk, apple butter, with an addition of sugar and lemon, the soft part of a baked apple, milk-soups with hominy and grits, the vegetable purees boiled with meat and butter added, all may be used if no contra-indication exists.

In some cases, though rare, rectal feeding may become necessary.

It is of the highest importance to direct the convalescence carefully and not allow the patient to pass observation till health is restored. Kidney affections, gastro-intestinal diseases, or tuberculosis follow frequently in the wake of the acute infectious diseases and the heart muscles are weakened, and some muscular fibers degenerate probably in almost every case. As soon as the temperature returns to the normal, craving for food becomes usually excessive, and many a severe relapse with fatal ending has been due to an injudicious diet during this time. If the patient has been on a rigid liquid diet, only a gradual change is permissible, testing digestive capacity, temperature and heart strength with the progress. Even during this time the patient should be encouraged to take large amounts of liquids to favor elimination of toxic substances and to protect the kidneys.

If the treatment has been judiciously conducted, the patient will come out as well, and often in a better state of nutrition, than before he contracted the disease.

DISEASES OF THE DIGESTIVE TRACT

The esophagus, whether contracted or dilated, needs protection of an inflamed mucous membrane by the administration of fats, olive and almond oil, butter and cream. The food must be rich in nutritive value, soft and well tempered, neither too hot nor

too cold, eggs in various forms, and in addition the artificial foods, the thick soups, especially milk soups, jellies, malt extract, honey and fruit juices. In less severe cases, vegetable purees pressed through a sieve. Rectal feeding of a subcutaneous injection of normal salt solution becomes necessary in complete stenosis.

In acute affections of the esophagus due to acids and alkalies, liquids may be given, usually with caution, about five to eight days after the injury.

STOMACH AND INTESTINAL DISEASES

In acute diseases of the gastro-intestinal tract, it is often necessary to stop feeding for several days, allowing nothing but water, to which, in some cases, fruit juices or weak tea may be added, cold, if the stomach alone is affected, tempered, if the intestines are involved; barley and rice water are useful. They protect and soothe the mucous membrane. After decided improvement, the nutritive value of soups may be enhanced with yolk of egg and butter, and as it continues, a more nutritious diet may be gradually substituted. Acute catarrhs can be cured with such a regimen, unless a serious etiologic condition is at the bottom of the trouble.

CHRONIC GASTRITIS WITH ANACIDITY AND SUBACIDITY

If the proteolytic function of the stomach is entirely destroyed, the organ serves only as a reservoir and the test breakfast, after removal, is unchanged, except for chewing and insalivation. These patients, however, may do well, the intestinal function compensating for the deficiency, unless motor insufficiency and diarrhoea, due to insufficient chewing, causes trouble. The most important rule in this affection is thorough cooking and chewing of the food. Coarse foods must be avoided, and meat and vegetables served in form of purees. A nice piece of roast excites the appetite better than a fine hash, and it is, therefore, preferable to have the patient cut the meat at the table. Instead of meat, eggs and fruit jellies, milk, buttermilk, clabber and soft cheese may serve as substitutes for meat. Salt and condiments will increase appetite, unless contraindicated by kidney disease, liver affections, and arteriosclerosis. Fat may be given as needed.

It is desirable to increase the secretion of gastric juice by means of appetizers and skilled preparation and serving of the food, except in cases of total achylia gastrica, but even then the intestinal digestion will be improved if the food is well prepared and served.

Hyperacidity and Hypersecretion is readily influenced by rational dietetic measures. The food has to be given in puree form—lumps and fibers irritates the gastric mucous membranes. In some instances, it may become necessary to begin the treatment with rectal feeding to secure thorough rest. Condiments, which may all be classed as irritants, have to be avoided, or given in moderation. The food is to be served neither too hot nor too cold, unless nausea exists, in which case small pieces of crushed ice often act like magic to settle the stomach. Coffee, tea and alcohol in small quantities are allowed.

Fats decrease secretion and protect an inflamed mucous membrane. Butter, cream, olive oil or fat emulsions, given in larger quantities before meals, stop pain and have a beneficial effect on bowel evacuations. This is of importance, as constipation is a frequent cause of hyperacidity of the stomach. Of the albuminous foods, eggs, soft cheese, and vegetable albumens are to be preferred. Meat is best boiled and only allowed in small quantities. The carbohydrates are poorly digested and should be given in moderation. Fruit juices freshly pressed, and not too acid, are usually well borne; and vegetable purees are useful as carriers of larger quantities of fat. Patients relieved by eating have to be advised to take something between meals, just enough to neutralize the acid; a cup of milk with limewater sipped, a cracker well chewed, or some grated hard boiled eggs, are suitable for the purpose.

If the motor-insufficiency exists, as is usually the case, small and frequent meals must be served; liquids only in small quantities at a time.

Patients who cannot take enough water by mouth must take it by rectal injection,—wine bouillon and salt may be added to the enema.

An addition of larger quantities of fat to the daily diet facilitates the emptying of the stomach. In severe cases, a fat, albuminous diet is indicated to which carbohydrates gradually may be added, as improvement continues.

The treatment of *gastric ulcer* has to be varied, according to the severity of the case, and when hemorrhage is present, feed-

ing by mouth has to be stopped and rectal feeding substituted. Absolute rest of the organ to save it, is of paramount importance, as tearing and pulling of the ulcer can not be avoided even if liquids are given.

If danger of inanition is great, a small addition of liquids may be tried by mouth.

To obtain good results by way of rectal feeding, a soft rubber tube with glass window to observe flow, is to be inserted into the rectum for some four to six inches. The injection should consist of about 300 c c of a thick liquid at body temperature, allowed to flow under low pressure. Not more than three injections are to be given in one day and a cleaning enema of one-half to one quart of normal salt solution should be administered in the morning, one hour before the first rectal feeding.

Milk is especially suitable; it contains fat in a finely emulsified condition; yolk of egg and sugar of milk are valuable additions. Salt and pancreatin or pancreon increase absorption.

Boas uses for one injection two hundred and fifty gm. of milk, two yolks of eggs, a pinch of salt, a tablespoonful of starch and a tablespoonful of claret. Strauss adds to this one or two tablespoonfuls of sugar of milk.

Thirst is allayed by moistening the lips with glycerine and rinsing the mouth with ice or lemon water.

In case of irritation of the rectal mucous membrane, six to ten drops of tincture of opium may be given with the nutrient enema. Feeding by mouth is best begun with milk, if well borne, a cupful every few hours, to which gradually yolk of egg and cream may be added. Fruit and meat jellies, yolk of egg and soups made of flour with an addition of butter and sugar, when milk can not be taken, may be given. Meat extracts are contraindicated in the first part of the treatment. As improvement continues give the clear broth of chicken with various additions in forms of soups; milk soups with yolk of egg, butter, cream and fine flour of wheat, rice, cream of wheat, soft scrambled eggs and omelet without crust, cream cheese with cream, later scraped chicken or tender steak and fish with butter sauce, finely mashed creamed potatoes and purees of the tender green vegetables, with apple butter, crackers, milk-toast, rice and macaroni.

This dietary regimen designed to save the organ, must be carried out for a long time, in a disease, that is prone to relapse.

When *carcinoma of the stomach* has been diagnosed, a similar plan of treatment has to be adopted, modified by existing con-

ditions, anacidity, hyperacidity and dilation, and as the disease so far has been proved to be incurable, the wishes of the patient have to be considered more than in any other trouble.

In neuroses of the stomach, patients that will digest a heavy meal one day and throw up milk toast the next, have acquired strong idiosyncrasies against certain foods, and dietary measures have to be altered to suit the case.

THE DISEASES OF THE INTESTINES

These are frequently associated with the diseases of the stomach, and in acute catarrhs, the indications for treatment are the same. Feeding has to be stopped for a few days, or reduced to a minimum. White of egg in water or water alone may be given. In cases of great weakness, especially cardiac weakness, small quantities of claret or whiskey may be added. In the severe forms of acute enteritis, in Cholera Asiatica and Cholera Morbus, when a rapid dessication of the tissues is progressing, subcutaneous injection, and in cases in which the colon is not specially involved, enteroclysis of normal salt solution, may be employed to counteract this threatening feature.

In sub-acute intestinal catarrhs, it is not necessary to withdraw food entirely, but it is better to continue a liquid diet for some time, to give the organ a chance to recover. It is the custom in the intestinal catarrhs due to typhoid, dysentery and malaria, not to change this diet till the patient has been free of fever for one week. When the appetite returns, milk, butter, eggs and cereals may be given in the form of soups. A pure milk diet, frequently employed, is not of advantage; it is too monotonous. In acute intestinal obstruction, feeding must be stopped till a diagnosis as to the character of obstruction can be made. Water may be allowed. It is not absorbed in the stomach, allays thirst, keeps the stomach clean, and can be withdrawn after ingestion.

Chronic catarrhs of the intestines require long treatment, and the selection of a suitable diet is of the greatest importance. The inflamed mucous membrane will not stand further insults. Hard particles of undigestible vegetable fibers and tendinous meat particles, raw fruits, salads, cold food and drink, pepper, mustard, salt and extractives, anything that may act as an irritant, must be avoided with the greatest care. In the severer forms, it is best to begin with a liquid diet, rice or barley water, milk with various additions, cocoa and tea, in form of soups, with sifted

flour, butter and yolk of egg added, followed by a semi-solid diet of mashed potatoes, tender white meat, and vegetable purees. Wasting, usually marked in catarrhs of the small intestines, may be counteracted by increase of butter and yolk of eggs. Milk, well borne in colitis, has frequently to be withdrawn in catarrhs of the small intestines. In these cases, it is first tried in small quantities and when a tolerance is established, the amount may gradually be increased. If stomach digestion is good, meat, finely chopped and freed from tendinous fibers, fish and eggs may be added to the diet.

Cold increases peristalsis and may give rise to severe colics. Warm drinks soothe. If absorption of fat is deficient, we have to limit the amount or withdraw it altogether, and substitute carbohydrates.

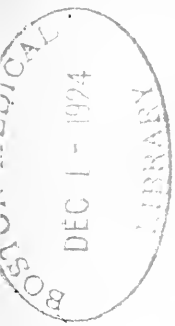
To treat chronic constipation, the character of the constipation, spastic or atonic, must be known. Fats, olive oil, butter and cream in larger quantities soften the fecal matter. Fruit sugar in the form of honey and sugar of milk, freshly pressed fruit juices and fruit jellies, apple butter and plum butter, buttermilk and clabber, when well borne, and vegetable purees increase movements and bulk. If the constipation is atonic, the same foods may be given in coarser forms. Raw fruits and stewed fruits with every meal, and of these, prunes, figs, dates and raisins, have a specially good effect.

Drinks may be given cold in forms of fruit juices and lemonades or aerated waters, to increase peristalsis.

In flatulency, foods that cause it, like cabbage, beans and peas, have to be struck from the diet, and in mucous colic—always a symptom of a catarrh, the diet advised for spastic constipation has to be adopted. In all inflammatory conditions of the intestines, dietary measures that have been outlined for spastic constipation, have to be adopted and in intestinal hemorrhages, the regimen for gastric ulcer must be used. In intestinal structures and appendicitis, it must be the object of the treatment to procure a soft and bland stool.

DISEASES OF THE LIVER

The acute diseases of the liver require a liquid and fever diet. During the acute attacks of cholelithiasis and cholecystitis, little attention need be paid to the nutritive value of foods; these attacks are as a rule of short duration. Frequent and small meals



have to be served. Passing of chyme causes the opening of the common bile duct and allows the flow of bile into the intestines. Warm drinks soothe; cold may cause colics. Bile emulsifies fats, yet a considerable amount will be absorbed, when given finely emulsified as milk, butter and cream, unless the pancreas is seriously involved; milk, malted milk, milk soups with additions of cereals purees of tender vegetables, fruit juices, tender meats and eggs may be allowed. The digestion of albumen and carbohydrates is not interfered with. Alcoholics, coffee and the condiments have to be struck from the diet. They are all injurious. Frequent and small meals prevent a sudden overloading of the portal system. Much has been said in favor and against the administration of larger quantities of liquid in order to insure a free flow of bile. Experiment does not favor the theory.

In obese patients with a fatty, weak heart, the amount of urine voided is a guide to the administration of liquids. In lean subjects with good circulation, the administration of larger amounts of liquid will probably prove beneficial.

Moderate amounts of albumen and fat, with larger quantities of carbohydrates, including sugar of milk, seem to be the best composition to save the liver parenchyme, and the food should be prepared, so as not to irritate the gastro-intestinal canal.

If the pancreas is seriously involved, it becomes a difficult problem to nourish these patients, and milk in some form, with additions as one or the other digestive function of fat, starch and albumen fails, will then be the diet. The administration of Pancreon or similar preparations is useful as a substitute for the missing secretions.

DISEASES OF THE HEART

The object of treatment is to lighten the heart's labor, to protect it from injurious and unnecessary stimulations and to strengthen its muscles.

An important feature of the treatment is to gradually produce a normal weight corresponding to the size of the patient, the most favorable condition for the proper functioning not alone of the heart, but of all organs. A state of under nutrition as well as over nutrition weakens the heart. The quantity and forms of the food may be varied according to the severity of the case. The diet must be rich, but not over rich, in albuminous foods, and contain enough of the carbohydrates and fats to meet the demand. Strong tea

and coffee, wine, beer and whiskey, meat extracts, the condiments, pepper and salt, stimulate and irritate and should be withdrawn, or given in moderation, or used when indicated. Foods that cause flatulency and large meals are injurious on account of the always more or less disturbed functioning of the digestive organs.

The amount of liquids to be allowed in heart disease is a factor of great importance; every drop of liquid ingested has to be pressed through the circulation before it can be eliminated. Hard and fast rules cannot be laid down; too many points bear upon this question,—the strength of the heart muscle of compensation, the function of the kidneys, the intoxication existing, and many others. It must be left to the physician to judge. Withdrawal or moderating the use of sweets and appetizers, especially salt, will diminish the call for liquids sufficiently. *Only in cases of a seriously broken compensation, perhaps with a co-existing hydraemia, a systematic reduction of liquids may be practiced with advantage. In some selected cases, a pure milk diet in small quantities, frequently given, may be tried to reduce a fat patient.*

DISEASES OF THE KIDNEYS

Similar measures have to be adopted in the diseases of the kidneys, in all of which the heart is taxed, and insufficiency of the heart muscle is the usual sequel of the chronic forms of Bright's Disease. Besides this the patient must be protected from the danger of renal insufficiency.

Meat extracts are irritating, and in some cases, meat may have to be entirely excluded from the nephritic diet. In others, white meats, containing less extractive matter, or a small quantity of any kind of meat may be allowed, quality and quantity to be considered.

Albumen is best increased by adding milk, cheese and vegetable albumen in form of soups or purees made of leguminous flours. Coffee, tea, alcohol and the condiments, salt and pepper, celery, radishes and raw onions are injurious. Asparagus is claimed by some not to cause trouble, whereas others exclude it from such a diet. Fats and carbohydrates do not irritate the kidneys and may be given in quantities to suit each case. Milk is an ideal food in nephritis and milk cures have been known in this condition for many years. In acute parenchymatous nephritis and in exacerbations of the chronic forms, such a diet is indicated; it limits the ingestion of toxic substances to a minimum. In the

chronic forms, and especially in interstitial nephritis, a disease that frequently lasts from ten to fifteen years or more, such a diet would be too monotonous and insufficient.

The nephritic polyuria has been spoken of as compensatory and antiuremic, depending on heart strength and vascular sclerosis barely sufficient to carry off the waste matter; yet it has been urged to flush the kidneys by giving milk in large quantities or adding water to the diet.

There is really nothing to wash out, and whether such procedure with more or less impermeable kidneys can be successful is questionable. It taxes the heart and the polyuria ceases as soon as the heart weakens. The first symptoms of uremia require prompt action. To dilate the capillaries and increase the permeability of the kidneys seem to be more rational and an easier way to get rid of toxic substances. In acute nephritis, it is desirable to free the tubules and glomeruli from debris. In these cases, if edema is present, the state of the circulatory apparatus must guide the administration of liquids. If the congested and diseased kidneys refuse to eliminate, the liquids will be retained and increase the edema. The natural thirst of the patient, established with a proper diet, after withdrawal of condiments, will be found a good guide in most cases.

Milk is the best diet with which to begin the treatment, gradually adding crackers, zweiback, tender vegetables, freshly pressed fruit juices, eggs and meat. Raw eggs are injurious in every case; they increase albuminuria.

In recent years, Strauss and many others have shown that salt is poorly excreted by diseased kidneys and that it gives rise to the characteristic local edema of nephritis. This is a further reason why salt should be used in moderation, or entirely withdrawn from the nephritic diet; though it is not necessary for patients that excrete salt fairly well to dispense with such a valuable creator of thirst and appetite altogether.

The amount of albumen taken by nephritics must be limited, as it has been shown that retention of nitrogenous substances may produce uraemic conditions and increase blood pressure. In cases with threatening uraemia, it has been struck from the diet. It must not be lost sight of, however, that it is necessary to keep the nutrition of the heart muscle intact. It is best given in these cases in the form of milk and eggs, *not raw*, and vegetable albumen. Meat, if needed, must be given with caution, fats and carbohydrates to suit the case; the latter preserve body albumen.

In inflammations of the ureters, bladder and urethra, a similar diet as that prescribed for the diseases of the kidneys must be selected. Lemonades and mineral waters should be used freely to dilute the urine. Linseed tea, especially in tenesmus of the bladder is soothing and has become a household remedy.

The liquids must be given at certain regular intervals. For instance, a cupful every two or three hours, and morning and night, if no contra-indication exists.

If *gravel and urinary calculi* are the cause of these conditions, it will depend on the nature of the sediment to select a diet. This can be done only, if the sediment is uniform—if it consists entirely of urates and uric acid, of phosphates or of axalate of lime. If the sediments are mixed, as is frequently the case, we can modify the diet to influence the reaction of the urine, and depend on general principles. Dilute the urine and keep the diet free from irritating articles of food.

Uric acid is derived from substances rich in nuclein, all kinds of meat and fish, especially such organs as liver, spleen, kidney, brain and thymus contain it, and must be struck from the diet. Meat, if boiled, is less injurious and may be allowed in small quantities. Nucleins also increase the acidity of the urine and cause precipitation of the sediments. A diet rich in limesalts will increase the solubility of the sediments. The alkaline mineral waters neutralize the acidity of the urine. In general, a milk, vegetable and fruit diet, with addition of eggs, a small amount of boiled meat and a liberal allowance of liquids, is suitable. It is far more difficult to influence the deposition of limesalts, oxalates and phosphates with dietary measures. These sediments are deposited in an alkaline urine, and in order to increase its acidity, we have to decrease the amount of liquids and increase the amount of meats contra-indicated in the majority of cases. In oxaluria, we have to withdraw vegetables that are rich in oxalic acid, such as spinach, rhubarb, cresses, tomatoes, beans, carrots, beets and asparagus, select a diet poor in limesalt and moderate the amount of milk and eggs rich in lime.

Phosphaturia is still less amenable to a dietetic treatment, but as this condition usually depends on disturbances of the nervous system, it needs little attention. The urine must be diluted and the diet modified as indicated in each case.

DISEASES OF THE LUNGS AND THE FAT MAKING DIET

The diseases of the lungs do not require a special dietetic regimen, with the exception of tuberculosis, which demands a fat making diet in common with other chronic infections. Such is

also the case in the chronic gastro-intestinal diseases and the paralytic type of Glenard's disease, the basis of tuberculosis and of neuroses.

A mere increase of nitrogenous substances in the diet does not cause an assimilation of albumen and increase of muscle, except during growth and in a state of malnutrition. Only exercise will cause muscular growth, if these conditions are absent. Rest favors the assimilation of fat; exercise that of muscle. In the beginning of such a treatment, absolute rest in bed or a prolonged rest is frequently indicated; with improvement, rest and exercise must be prescribed in proper proportion. Increase of fat and carbohydrates coupled with rest causes fat assimilation. Fat, ingested in small quantities, is almost all absorbed and of the carbohydrates, that portion not used for the production of heat and energy is converted into fat and some glycogen. Even then, exercise especially in the open air is the best appetizer and should not be dispensed with, if possible.

From the foregoing, it is plain why nitrogenous substances should be given in slight excess, and fat and the carbohydrates allowed in larger quantities. Fat to be given in forms of milk, cream, butter, the yolk of egg and cheese. To these, some of the artificial food preparations and plant fats may be added. Meat fat is hard to digest and usually not liked. To increase the appetite, a liberal use of appetizers is necessary, condiments and salt, which may be added to milk or may be given in forms of caviar, herring, sardines, crisp bacon, etc. The sensation of thirst caused by it ought to be satisfied with milk to which cream and yolk of egg has been added. Most patients like butter and it should be used freely. The green vegetables take up large amounts, also bread and potatoes. Coffee, tea and cocoa are used to disguise the taste of milk.

Malt extracts, small quantities of wine, ale or porter are sometimes found excellent appetizers. The preparation and serving of the food must be careful and designed to excite the appetite. Bread is best given well toasted in thin slices, as crust of bread and as crackers are easily crushed with the teeth and mix with saliva. Macaroni, grits, oatmeal and similar dishes are served in forms of soups with milk.

The number of meals during the day and the quantity served with each meal depend largely on climatic conditions; on the habit of the patient; the food at disposal and the progress of the treatment as shown from week to week by the scales, his general

appearance, and by his subjective feeling. A small quantity in the morning, increase of the amount towards noon and decrease towards night, is usually a good plan to follow.

DISEASES DUE TO FAULTY METABOLISM

GOUT

The dietetic treatment of gout differs little from the regimen in the acute infectious diseases, though meat, meat extracts and alcoholics must not be allowed during this time, unless heart disease or weakening of this organ is a complication. In such a case, alcohol may be given in small quantities, especially to patients that have been accustomed to its use. Small and frequent meals, consisting of milk, milk soups, jellies and the tender vegetables in puree form, free from condiments form the diet.

The treatment of the chronic form of the disease differs materially and we have to consider many factors in the selection of a suitable diet. A feature of the disease is an excess of uric acid in the blood serum, which through some unknown cause, perhaps a ferment, is precipitated, giving rise to the many well known symptoms. This foreign irritating substance in the blood, constantly eliminated by the kidneys, affects these organs in the course of years, and finally causes arterio-sclerosis, interstitial nephritis and the precipitation of gravel and calculi, hypertrophy and dilation of the heart. A diet similar to that indicated in kidney and heart diseases will be prophylactic and curative in most cases.

The elimination of uric acid must be aided by the increase of liquids in forms of milk, water and diluted fruit juices, to be given at regular intervals, the quantity to be determined by the state of heart and kidneys. Uric acid formation has to be reduced to a minimum by the exclusion of meat and meat extracts, especially of the organs which contain large amounts of nuclein. Whether it is advisable to depend entirely on a vegetable and fruit diet to increase the formation of alkali, and to give an abundance of alkaline waters is still under discussion. To avoid an excess of alkali seems to be correct. These patients usually have been heavy meat eaters and to withdraw meat entirely, is irrational. Meat, if allowed should be given in the less injurious forms of boiled meats and fish, and a more liberal use of eggs, milk and the vegetable albumen may serve as substitutes.

There is no contra-indication to give fats and carbohydrates; they have no influence on the formation of uric acid and may be given as indicated in each case. The condiments, salt and pepper, have to be used in great moderation; they tax the kidneys, and it is especially these organs upon which we depend for elimination, and which we have to protect as far as possible from injury.

The fruit juices, the orange cure of California, the grape cure of Meran, the strawberry and cherry cure of other places, are not borne out by recent scientific investigations. Their success, however, shows that a liberal addition of fruit to the diet is advisable in gout.

The disease is inherited and acquired. The usual cause of it is excess in eating and drinking. It must be the object of the family practitioner not to be satisfied by treating the patient, but to form the habits of the child entrusted to his care. Early impressions are lasting and the habits formed during childhood remain during life.

DIABETES MELLITUS

The selection of a suitable diet is the most important therapeutic measure in this disease, the main symptoms of which are an excess of sugar in the blood and its excretion by way of the kidneys. The physician's resources are taxed to conduct the treatment. Not only has he to consider the various factors that govern the dietary treatment of other diseases, the climate, the seasons, the state of nutrition, the occupation, the severity of the disease, and the many complications that on account of the condition of the blood accompany Diabetes Mellitus, but it becomes especially difficult as the dietary measures have to be severe and deprive the patient largely or entirely of man's main articles of food, bread and carbohydrates in other forms. The complications due to the blood condition are numerous. There is not an organ in the body that may not become affected. Disturbances of the gastro-intestinal tract are constant. Tuberculosis is a frequent accompaniment, also arterio-sclerosis, myocarditis, diseases of the pancreas, liver and kidneys and affections of the nervous system, in the form of peripheral neuritis, neuralgias and puritus, of the skin, in forms of furunculosis and carbuncles, disease of the eye, such as cataract.

The etiology of diabetes mellitus has to be considered, whether the disease is due to gout, of nervous origin, or due to an excessive ingestion of starches and sugars.

In every case of nervous origin, the pancreas, liver and muscles are involved.

The heredity of the disease and the influence of traumatic and psychic causes are readily explained; they indicate a weakness of the nervous system inherited or acquired or temporarily weakened by toxic substances. If due to tumor or abscess of the brain, surgical interference is called for.

If the disease runs in families, the practitioner must regulate the habits of the children, and reduce the amounts of carbohydrates. It is well to remember that the descendants of syphilitics, goutics, neurathics and the obese, often become the victims of diabetes in later life.

To facilitate study and treatment, the disease has been divided in two large groups, one gradually passing into the other, a light form and a severe form. The former is characterized by the entire disappearance of sugar from the urine after a diet free from carbohydrates for three or four days. The disease is classified as severe when a reduction of albumen has to be made in the diet to cause the sugar to disappear, and according to the amount of albuminous food that has to be withdrawn. Various subdivisions have been recognized by different authors. The object of the treatment of any of the forms of Diabetes is to free the blood from noxious substances, especially from sugar, to prevent acidosis, to keep the patient in as good a state of nutrition as possible.

Before the treatment can be commenced the tolerance of carbohydrates has to be established.

If, after a test diet containing one hundred g. wheat bread, given in three or four portions during the day, sugar is still found in the urine, a further reduction and an entire withdrawal of carbohydrates may become necessary, and if after eight or ten days, the urine still contains sugar, albumen has to be reduced to settle, whether the disease is to be classed as severe. If, on the other hand, no sugar is excreted with one hundred g. wheat bread, the amount is gradually increased till the first sugar reappears.

It is not alone necessary in every case of Diabetes to test the tolerance of the patient in general to carbohydrates, and to albuminous food in the severe forms, to find out whether the urine can be freed of sugar with a restricted diet, but also to test in a similar way his tolerance to the different carbohydrates, especially to milk.

Tolerance depends on the form and quantity in which carbohydrates are allowed at a time. In general, it may be said, that they are best given frequently and in small quantities, in form of vegetables. Cellulose encloses starch granules and slows absorption.

Of the sugars, levulose is best borne and may be used in moderation in many cases. The quantity in which the food can be given is of importance, a diabetic does not need more than a healthy person, and even less in some cases, to keep his weight and his strength.

The regular diet in severe cases of diabetes is to be made up of albumen and fat, with an occasional interruption of vegetable days, with water, wine, tea and coffee added, or the liquids alone, to obtain improvement.

To prevent acidosis, alkalis have to be given in large doses and butter has to be kneaded with water to extract the lower fatty acids that might induce it.

If such a strict diet, after several weeks proves insufficient to prevent sugar excretion, the albumen, or if necessary, the whole quantity of food, must be reduced, or *days of starvation* introduced. If this regimen fails, carbohydrates may be added and not rarely a portion is assimilated, and the patient gains in strength and weight. Alimentary albuminurias are occasionally met with; they disappear with the disappearance of the sugar from the urine.

These directions are given by Naunyn and von Noorden:—

In 1910 Guelpa of Paris asserted that by withholding all food and by thorough evacuation of the bowels with a saline laxative, sugar may be made to disappear from the urine in most cases of Diabetes within three days. The treatment of fasting and purgation should be repeated once or twice to cause complete and often permanent disappearance of sugar.

Bordet and others confirmed Guelpa's assertions. Kellogg treated two hundred and sixty-seven diabetics with "most gratifying results", utilizing the principle brought forward by Guelpa.

Allen of the Rockefeller Institute has further added to our knowledge with this method of treatment.

Besides causing the rapid disappearance of sugar from the urine, the starvation method, according to Guelpa, secures with other minor advantages:

(1) Very marked change in the intestinal flora with a reduction of the number of bacteria. (2) Lowering of blood

pressure when high, with increase in the percentage of hemoglobin and the number of red cells. (3) Reduction in the volume of the viscera when enlarged, especially of the liver. (4) The disappearance of pain in the joints and muscles. (5) A general feeling of wellbeing, suppleness and readiness for mental or physical activity and less necessity for sleep.

A number of authors have recommended a milk diet. Such a diet is of advantage in selected cases for a certain length of time. It is bland and non-irritating; it saves the organs, increases elimination and its nutritious value can be enhanced by condensing it and adding cream. Before use, tolerance has to be tested. It does not diminish sugar excretion in all cases, but increases it in some. The amount of carbohydrates contained in buttermilk is but little less than those contained in sweetmilk.

A diet consisting entirely of vegetables has also been recommended and has its advantages under certain conditions. It contains the carbohydrates in a form that resists rapid absorption. It relieves obstinate constipation, replaces the distressing sensation of hunger by serving as a filler, contains a large amount of alkalies, counteracting acidosis and the chlorophyll exerts, according to some authors, a beneficial influence on the disease. The rice cure of von Duering, which was formerly frequently used and consists of a diet made up of rice, with an addition of fruit, milk, and claret, has been abandoned. Masso's potato cure and von Noorden's oatmeal cure have taken its place. The latter has especially been found favorable.

Von Noorden has limited its application to the most severe cases of Diabetes with acidosis, and warns against adopting it as a routine treatment. It consists of the sole administration of oatmeal gruel given every two hours. The average quantity per diem is two hundred and fifty g. oatmeal with an addition of one hundred g. egg and plant albumen and three hundred g. butter. The greatest objection is the aversion of the patient to the diet, and it should be discontinued at once, if he loses in weight and strength.

The oatmeal treatment is preceded by a few days of strict diet and one or two vegetable days. The best results are obtained in severe cases of children and young adults.

The craving for bread and potatoes is so great that in no case can these articles be permanently dispensed with, and it is advisable to give bread in small quantities on certain days, in order to satisfy the craving. Some patients refuse to take bread

in any form, other than that to which they have been accustomed in health. Others still take it in forms that have been especially prepared. All contain more or less carbohydrates and the amount should be known. The patient, as a rule, is under the impression that he can take any quantity of the so-called diabetic bread without harm.

Potatoes contain only twenty-four per cent. of carbohydrates and can be given in larger quantities.

The different forms of albuminous foods influence the disease but little. The slower the digestion and absorption the better their influence on sugar excretion, so that egg and plant albumen deserve some preference. One hundred—one hundred and forty g. of albuminous foods are sufficient in the lighter forms of the disease. The diet can be made up of mutton, beef, game, fowls and fish in any form. Eggs poached, soft-boiled, fried as omelet and omelet soufflé; oysters, broiled and raw; the various cheeses, cream and milk, if not contra-indicated by the test for tolerance; crabs and lobsters; the various wine and meat jellies; sauces prepared without flour; anchovies; tomatoes; Worcester sauce; catsup; red snapper and other fish; meat and vegetables and fruit, we have a large variety to select from; spinach, turnip greens, mustard greens, beet tops, cauliflower, green cabbage, snap beans, asparagus, tomatoes, lettuce, cresses, celery and many more. These must be well prepared and seasoned; all have the great advantage to serve as fat carriers. The acid juicy fruits are specially desirable. They are refreshing and allay thirst. Lemon, grape fruit, sour oranges, apples, cranberries, olives, nuts and almonds are beneficial. Fruits may be used raw or stewed and sweetened with saccharine. The condiments are necessary when the appetite fails, which is often the case in a one-sided diet. Alcohol in some form, especially in severe cases, is to assist fat digestion and enhances the appetite. Alcohol should never be entirely withdrawn from the aged or from patients that have been accustomed to it. It is best given in forms of dry wines, Mosel, Rhine wine and claret or as Cognac and whiskey in small doses. Beer is contra-indicated in diabetes. A good and sufficient variety can be obtained even with the strictest regimen. A careful selection must be made, so as to meet all complications.

If coma threatens, carbohydrates must be added to the diet. Milk and levulose in forms of lemonades should be given and the daily amount of alkalies increased.

If the patient is in a stuporous or comatose condition, rectal injections of sodium bicarbonate and sugar of milk, or intravenous injections of physiologic salt solution or levulose, in strength from five to ten per cent., often gives good results. If on account of the severity of the disease, a strict diet has to be adopted, a quantity of carbohydrates has to be allowed greater than the tolerance test permits. Periods of a strict diet to free the blood for a certain length of time from sugar are to be followed by a more liberal diet. The length of these periods, as well as their frequency, depend on the severity of the case, the general condition of the patient and complications. The final object to be obtained is to restore the patient to health or keep him in a good state of nutrition.

OBESITY

To treat this disease according to a fixed plan is incorrect, yet a number of cures have been practiced of which Banting's cure has been popular. The habit of the patient and the over activity, or under activity of thyroid, thymus, ovaries and testicles must be considered; the condition of the internal secreting glands, increase or decrease the craving for food and affects its assimilation; an excessive use of salt, pepper and condiments, which allow people to eat under any condition—has to be corrected.

There are three stages in the life of the obese. The first when, firm of flesh and robust in appearance, he is envied by his friends. The next is the Falstaffian age, when he becomes the object of ridicule, and the third, when suffering from edemas, cough and dyspnoea, he arouses sympathy. It is generally at one of the later stages that we are called upon to treat, unless fashion dictates a slender figure, and women flock to the physician's office to be "reduced".

Though lightly looked upon, Obesity is a serious disease, which disables the patient and shortens life. It is only when a severe pain and breaking down of the heart causes fright that we are consulted. As a rule, these people love to eat and drink, and if the disease is inherited, the taste for high living goes with it. They know that diet and exercise make up the treatment and are reluctant to give up their habits, the more so as the organs gradually accustom themselves to carry the increasing weight and activity becomes less in proportion. There are quite a number that tell us they don't eat anything, but if we inquire into

their habits and the amount of food they take, we usually find that it is out of proportion to the daily exercise. In some cases, thyroid, ovaries, testicles and other glands are at fault. The first and more rapid loss of weight is due to loss of water, of which these patients possess more than the usual amount. All liquids have to be reduced. The first reduction in weight is easy, but the progress slows when it comes to fat combustion. The co-operation of the patient must be secured and he must understand the work he has to do, the sacrifices he has to make, and the length of time it will take to secure permanent results. If he does not suffer much, he will not readily give up habits that have become dear to him and change a life that has become his second nature.

To restore the patient to health, he must lose fat and make muscle; exercise is necessary for fat combustion and causes muscular growth. The fundamental principle of all treatment is to guard the body albumen from loss and to give nitrogenous food in sufficient quantity, as well as for increased assimilation. The average amount for an adult will hardly ever be less than one hundred and twenty grm. per twenty-four hours. It is desirable to reduce the number of calories and keep as far as possible the accustomed volume of the food. The increase of firmness and bulk of muscle and loss of weight furnish sufficient data to gauge the amount of food to be allowed.

Whether we adopt a plan of rapid or slow reduction must depend on the state of the patient. The rapid reduction is best carried out in a sanatorium, to prevent complications. The slow reduction has the preference, as it allows the patient a more liberal diet and trains him to form healthy habits. It is best to interrupt a continued treatment, by intervals of a more liberal diet, during which time the weight has to be kept stationary. Fat and carbohydrates are fat producers, and as a rule it is best to reduce both, guided by the habits of the patient and the result of the treatment. Some authors recommend a greater reduction of fat, others of carbohydrates, in their dietary regimen. It is best to determine this in each case; fat is more readily assimilated and it takes work by the organism to convert carbohydrates into fat.

Albumen is best given in forms of lean meats, though eggs may be added in various forms to assure a variety of the diet. notwithstanding the yolk contains a larger amount of fat, lean fish, oysters, lobsters and crabs may be added. Green vegetables,

well cooked and well prepared with meat juice to make them palatable, and the acid and juicy fruits, give a chance to get a voluminous diet poor in calories. The amount of fats and carbohydrates to be permitted in each case must be determined and changed according to varying conditions. Black bread, Graham bread and the specially prepared bread for diabetics, being poor in calories, deserve preference. The cereals, grits, hominy, oatmeal and rice are either entirely to be struck from the diet, or allowed only occasionally. Potatoes may be given in larger quantities; they contain twenty to twenty-four per cent. of carbohydrates. Saccharine and similar preparations can be used to sweeten; one tablet corresponds to a large lump of cane sugar.

Three meals a day are usually sufficient during the treatment, however, a soft boiled egg, some fruit, a cup of tea and the like, may be allowed, if patients feel faint between meals. As a severe restricted diet, a pure milk diet may be adopted for a short time; one quart a day, a cupful every two hours.

Rosenfeld has introduced the potato cure and claims that it gives some good results. He allows large quantities of potatoes and cold water with the object to reduce the appetite. This is a severe treatment, is not liked by the patient and taxes his digestive organs. If the treatment is conducted with skill, it is possible to obtain permanent results in most cases without causing the patient any suffering.

The following directions may serve as a guide to design special diets. They have to be modified according to custom, financial condition of the patient, climate and severity of the disease—several may have to be combined to meet the indication in a given case.

DIET IN DISEASE

DIET IN OBSTRUCTION OF ESOPHAGUS, PYLORUS AND DUODENUM

The day is commenced with a wineglass or one or two tablespoons of olive oil, sweet almond, liquid petrolatum, melted butter, an emulsion of codliver oil, to suit the patient's taste. If stagnation of food is present, lavage must precede the administrations of the oil.

The meals, consisting of the food previously discussed, are then served every two hours, the quantity to be increased at noon. In the afternoon the food is given every three hours, lessening the quantity towards bedtime.

DIET IN GASTRITIS

Breakfast—A cup of tea and milk or cream, a few slices of stale bread, Graham bread or toast and butter, a soft boiled egg or two and a slice of crisp bacon.

Dinner at noon—Purees of the tender green vegetables in butter, spinach, green peas, snap beans, asparagus, carrots, mashed potatoes, meat of chicken, veal or fish, macaroni, rice and other cereals, when needed, apple butter, the inside of a baked apple, or custard, as a desert.

Supper—A cup of milk with tea or cocoa, eggs, soft boiled or poached, bread and butter, as at breakfast.

To be forbidden are fresh bread, difficult to reduce to a fine pulp, the coarse vegetables, cabbage, beans, and peas, smoked meat and fish, lard, acid, candies, cakes, pastry, pies, cold drinks and ice cream. Condiments are injurious in an acid gastritis and beneficial in the anacid form.

DIET IN ULCER AND EROSIONS OF THE STOMACH

First period—From two to three quarts of milk, during the day, or instead meat and milk soups, to which cream and a little butter may be added.

Second—Calf's foot jelly, mush, tender chicken and squab, scraped boiled ham and Zwieback or cracker.

Third—Mutton chop, tender boiled veal, finely mashed potatoes, purees of the green vegetables and toast.

Fourth—Tender steak, boiled fish, light puddings, with custard and fruit juice.

Each period to last from eight to ten days or longer. About six meals a day are to be given.

FORBIDDEN—Bread, boiled potatoes, the coarser vegetables, pastry, pies, candies, pork, and all articles difficult to digest, for several months.

DIET IN INTESTINAL CATARRHS WITH LOOSE BOWELS

Breakfast—A cup of cocoa and milk, a soft boiled egg or two, finely scraped boiled ham and a slice of toast and butter.

Dinner—A milk soup with rice or farina, macaroni a piece of tender white meat and in the milder case, the vegetable purees, roast and fish, a glass of huckleberry wine or claret, may be added slightly warm, stewed fruits or custard, as dessert.

Supper—A cup of tea or cocoa with milk, a slice of toast and butter, a soft boiled or poached egg, and at bedtime, a cup of hot peppermint tea.

FORBIDDEN—Cold drinks and ices, the coarser vegetables, rye bread and fresh bread, cheese, acids, cakes, pastry, pies, candies, coffee, lard, gravies and raw fruits.

FAT MAKING DIET

The diet must be combined with rest.

Breakfast—A cup of tea or cocoa with cream—mush with milk and butter, or a cream soup with cereals, toast or Graham bread and butter.

Between breakfast and dinner—Cup of tea and cream, a slice of crisp bacon or boiled ham with toast and butter.

At twelve—dinner—Lettuce and olive oil or mayonaise, the green vegetables in butter, creamed mashed and baked potatoes in butter, pudding with custard or fruit juice.

Between dinner and supper—A cup of bouillon with egg, toast and butter.

Supper—A cup of tea or cocoa and cream, toast and butter, soft boiled egg.

Early supper and bedtime—In constipation, the stewed fruit and the sour products of the milk, cream cheese, clabber, buttermilk with cream and Graham bread instead of toast.

In the wasting diseases, in visceroptosis, phthisis, and in the anemias, when such a diet is required, it is better to serve six meals a day, rich in butter and cream—the main meal in the middle of the day.

DIET IN CONSTIPATION

On rising a glass of cold water, half an hour later breakfast.

Breakfast—A cup of coffee or weak tea with cream, Graham bread, butter and honey, or instead clabber, buttermilk or cream cheese.

Dinner—Lettuce and olive oil—the green vegetables, creamed or boiled potatoes with butter, a small piece of meat or fish, and stewed fruits, or juicy fruits raw, as a dessert.

Supper—A glass of buttermilk, a plate of clabber, a soft boiled egg or two, with Graham bread or rye bread and butter.

In the spastic form of constipation, all foods must be soft, the vegetables as purees, and raw fruits must not be given. Sweetening should be done with sugar of milk—a tablespoonful to the cup.

DIET IN OBESITY

The diet must be combined with exercise.

Breakfast—A cup of coffee with skimmed milk, one or two eggs, a slice of Graham bread or rye bread, with a trace of butter.

Noon—The green vegetables, a baked potato, a piece of lean meat, baked apple, without sugar and cream, cranberries or raw juicy acid fruits, as a dessert.

Supper—A slice of bread and a cup of tea and lemon.

DIET IN DIABETES

Breakfast—A cup of tea or coffee, with milk. One or two soft boiled or poached eggs, a slice of boiled ham, a slice of toast or Graham bread with butter.

Dinner—A plate of consomme, lettuce, the green vegetables, a small piece of meat, a baked potato, and some acid fruit, as dessert.

Supper—A cup of tea or cocoa and cream, a slice of toast or Graham bread and butter.

Amount of carbohydrates according to the severity of the disease. Some must be allowed in every case. A teaspoonful of bicarbonate of soda twice or three times daily, two hours after meals, to prevent acidosis.

The oatmeal diet should be prescribed in every case of severe acidosis, and it is well to follow v. Noordens directions, who inaugurated this treatment, and who has probably the greatest experience with it. This author gives two hundred and fifty g.

oatmeal per day in form of soups of porridge, served every two hours. To this he adds two hundred—three hundred g. butter and in certain cases one hundred g. vegetable albumin, or five to eight eggs. Black coffee, tea, lemon juice and some whiskey may be allowed on oatmeal days. v. Norden precedes and follows from three to four oatmeal days with one or two vegetable days.

During days of starvation, black coffee, tea and whiskey should be given at regular intervals, best every two or three hours.

GOUT

Red meat and the meat of organs must be forbidden to diminish uric acid formation. Permitted are carbohydrates, fruits and vegetables, white meat and eggs in moderation.

DISEASES OF THE LIVER

A diet poor in fat, rich in liquids, if the heart and vessels are intact, and the kidneys are permeable; withdrawal of condiments and frequent small meals to cause the opening of the papilla and to encourage the free flow of bile.

DISEASES OF THE HEART

The diet differs in states of compensation or broken compensation, more in company, than in quality. Both require a larger amount of proteids to strengthen the heart muscle—large meals are contra-indicated, and coffee, tea and alcohol condiments should be used only in selected cases. Reduction of liquids when insufficiency of the heart muscle is present.

DISEASES OF THE KIDNEYS

Care of the heart muscle in all, but especially the chronic cases. Exclusion or reduction of meat extracts. Meat may have to be entirely struck from the diet list, or white meat given, according to the state of the disease. Condiments, coffee, tea and alcohol allowed in moderation in selected cases. Tablesalt is injurious in cases with edema.

DIET IN CANCER.

Bulkley thinks that cancer is but a deviation from the normal life and action of the ordinary cells of the body, which for some reason, difficult to understand, take on an abnormal or morbid action; with this there is a continued tendency in them to a malignancy, which invades contiguous tissue, associated with a pernicious anemia, which in the end tends to destroy life.

He believes that the simple life with the avoidance of the dietetic and other causes, which have been found to induce cancer in nations and individuals, promises the best hope for the arrest of its rapidly increasing development and mortality throughout the world, which from 1900 to 1915 steadily has risen 28.7 per cent. under the present treatment of surgery, with an ultimate mortality of about 90 per cent. of those once afflicted with cancer, whereas a decrease of mortality of 27.8 per cent. has been obtained in tuberculosis during the same length of time under medical treatment.

A purely vegetable diet is the basis of his treatment, which he combines with other therapeutic methods, as they are indicated. He reports a number of early and advanced cases cured and inoperable hopeless cases relieved and their lives prolonged.

In view of the appalling rise of mortality under the sole treatment of surgery of the dreaded disease and of the hope, his treatment holds out, which is in line with the principles laid down in this book, I give in full diet lists and directions of this author whose work should be read. The remarkable results of his treatment are related in his work. "Cancer, its cause and treatment," by L. Duncan Bulkley, Senior Physician of the N. Y. Cancer Hospital. Published by Paul Hoeber, 1917, New York.

The tables and directions are taken from his book.

FIRST DAY.

Breakfast—Baked apple, 4 ounces rice, 3 ounces corn bread, $1\frac{1}{4}$ ounces butter, $\frac{1}{2}$ ounce sugar, hot water.

Dinner—5 ounces tapioca soup, 3 ounces baked potatoes, 3 ounces stewed celery, 3 ounces peas, 1 ounce Graham bread, $1\frac{1}{4}$ ounces butter, 1 fresh apple.

Supper—4 ounces rolled oats, 2 ounces white bread, $1\frac{1}{4}$ ounces butter, 4 ounces stewed prunes, $\frac{1}{4}$ ounce sugar, very weak tea.

SECOND DAY.

Breakfast—Orange, 4 ounces hominy, 2 ounces Graham toast, $1\frac{1}{4}$ ounces butter, $\frac{1}{2}$ ounce sugar, Postum.

Dinner—5 ounces pea soup, 3 ounces macaroni, 3 ounces string beans, 3 ounces carrots, 2 ounces bread, $1\frac{1}{4}$ ounces butter, dates.

Supper—4 ounces Cream of Wheat, 2 ounces white bread toast, $1\frac{1}{4}$ ounces baked apple, 2 ounces crackers, $1\frac{1}{4}$ ounces butter, $\frac{1}{4}$ ounce sugar, very weak tea.

THIRD DAY.

Breakfast—Banana, 4 ounces Pettijohn, 2 ounces white bread, $1\frac{1}{4}$ ounces butter, $\frac{1}{2}$ ounce sugar, hot water.

Dinner—5 ounces corn soup, 3 ounces baked potatoes, 3 ounces squash, 3 ounces boiled onions, 2 ounces bread, $1\frac{1}{4}$ ounces butter, raisins.

Supper—4 ounces Farina, 4 ounces stewed figs, 2 ounces Graham crackers, $1\frac{1}{2}$ ounces butter, $\frac{1}{4}$ ounce sugar, very weak tea.

FOURTH DAY.

Breakfast—Raw apple, 4 ounces cornmeal mush, 2 ounces Graham bread, $1\frac{1}{4}$ ounces butter, $\frac{1}{2}$ ounce sugar, Postum.

Dinner—5 ounces vegetable soup, 4 ounces baked beans, 3 ounces cauliflower, 3 ounces asparagus, 2 ounces bread, $1\frac{1}{4}$ ounces butter, figs.

Supper—4 ounces rice, 4 ounces stewed prunes, 2 Graham crackers, $1\frac{1}{4}$ ounces butter, $\frac{1}{4}$ oz. sugar, very weak tea.

FIFTH DAY.

Breakfast—Orange, 4 ounces cracked wheat, 3 ounces corn muffins, $1\frac{1}{4}$ ounces butter, $\frac{1}{2}$ ounce sugar, hot water.

Dinner—5 ounces sago soup, 4 ounces spaghetti, 3 ounces lima beans, 3 ounces boiled onions, $1\frac{1}{4}$ ounces butter, dates.

Supper—4 ounces Cream of Wheat, sliced orange, 2 ounces oatmeal crackers, $1\frac{1}{4}$ ounces butter, $\frac{1}{4}$ ounce sugar, very weak tea.

SIXTH DAY.

Breakfast—4 ounces Samp, 3 ounces Graham toast, $1\frac{1}{4}$ butter, $\frac{1}{2}$ ounces sugar, Postum.

Dinner—5 ounces celery soup, 4 ounces baked potatoes, 3 ounces carrots, 3 ounces spinach, 2 ounces bread, $1\frac{1}{4}$ ounces butter, 1 orange.

Supper—4 ounces Cream of Wheat, 4 ounces stewed figs, 2 ounces Saltine biscuit, $1\frac{1}{4}$ ounces butter, $\frac{1}{4}$ ounce sugar, very weak tea.

Repeat this bill of fare on successive days.

Some interchange of the different articles may be made according to the season and to suit the appetite or convenience of patients; but in the main this bill of fare should be followed, with occasional substitution of similar articles, if necessary.

Bread at least 24 hours old may be taken as desired.

A little old cheese may be grated on the macaroni and spaghetti, but not cooked with it.

One boiled or poached egg may be taken for breakfast every other day, and very fat bacon on the alternate days, unless otherwise directed.

It is desirable to eat the skin of potatoes, baked or boiled.

Each and every meal should be eaten very slowly, for at least half an hour, with long chewing.

One tumbler of water, not iced, is to be taken with each meal, but not when food is in the mouth; also a tumbler full of hot water, one hour before breakfast and supper.

No milk is to be taken unless specially ordered.

The vegetable soups are to be made from a stock composed of the water in which all vegetables, including potatoes, have been boiled, added to, day by day, kept hot, and allowed to evaporate; a portion is each day thickened as desired with barley, rice, farina, sago, vermicelli, etc.

The cereals are to be boiled with water, three or four hours, and may be cooked in the afternoon and re-heated in the morning, adding more water. Rice, farina and Cream of Wheat require only an hour. Chopped dates, figs, raisins, or currants may be added to cereals when desired.

All the cereals are to be served very hot, on hot plates, and eaten with butter and salt to taste (not milk and sugar). They are to be eaten very slowly, with a fork, and very well chewed.

The crackers with supper may be varied to suit the taste; they should be eaten dry, with butter, and chewed very thoroughly.

Nothing should be taken between meals, unless especially directed, and the life should be as simple and healthful as possible, with early and long bed hours.

CONCLUSION

The object of the dietetic treatment is to produce blood as far as possible free from impurities, containing in sufficient quantity the elements to produce heat and energy as needed and replace the burnt up body albumin and fat. Though it forms only one item in the treatment of disease, it is of great importance. With a fair knowledge of the physiology of digestion and the value of food stuffs, it is not difficult to prescribe a diet, provided that a correct diagnosis is made. As has been pointed out, an often neglected factor in prescribing a diet is the consideration of climate, season and occupation, which may increase or decrease the need of food. People enjoy eating and wish to procure the pleasure it gives. This leads to an excessive use of condiments, alcoholic stimulants, pepper and salt, which have to be withdrawn before we can ascertain the normal appetite and thirst.

The patient should not eat when fatigued, nor eat anything he has found to disagree, nor anything he does not like. He has be taught to like what is good for him. These are valuable rules.

CHAPTER IV

REST

Rest is the supreme remedy of nature, and during sleep—that is, during physical and mental rest—her best work is done.

In the recumbent posture circulatory and respiratory activities are slowed, and organs distended and engorged with blood during work return to their normal size, rest individually, and allow repair of daily wear and tear of injuries received.

Rest in the recumbent posture is the most powerful prophylactic and therapeutic agent we possess, and its value, appreciated by the laity to a large extent, is undervalued by the medical profession. Though it is true that the surgeon entirely relies on rest after his operation to heal the wounds he made, and though physicians advise rest in bed and employ it, thanks to the labors of Weir Mitchell, Playfair, and others, in certain nervous diseases, we are far from prescribing it as a remedy in every disease. I have never seen in print nor have I ever heard of such an explanation, though I have searched for it, being impressed with the importance of rest to cure disease ever since I have practised medicine.

Weir Michell in his book—"Fat and Blood"—1911, 8th Edition, page 70, says:

"I have often asked myself why rest is of value to the cures, of which I am now speaking. We meet now and then with feeble people, who are dyspeptic, and who find that exercise after a meal, or indeed much exercise on any day, is sure to cause loss of power, or lessened power, to digest food. The same thing is seen in an extreme degree in the well known experiment of causing a dog to run violently after eating, in which case digestion is entirely suspended. Whether these results be due to the calling off of blood from the gastric organs to the muscles or whether the nervous system is, for some reason, unable to evolve at the same time the force needed for a double purpose, is not quite clear, but the fact is undoubted, and finds added illustrations in many of the class of exhausted women." By rest we slow the machinery.

Hilteon in "Lectures on rest and pain" (1910—5th Edition) calls rest a curative agent, and a great boon given by the Lord to mankind.

Others have nothing to say on the subject.

Recognizing the fact that nothing but the blood itself cures, that physicians and surgeons only can assist nature *by purifying it, and correcting its composition and bringing it where needed*, I was forced to consider drugs and methods of treatment only as means to accomplish this end. Whether we employ specifics like quinine in malaria, antitoxic serum in diphtheria, and mercury and arsenic preparations in syphilis, or any other remedy, we only purify the blood, change its composition, increase its defensive powers, and influence its distribution.

The recumbent posture is the most important measure to influence the circulation beneficially, and nature forces us to assume it with pain, with chills, and with fever, wherever it becomes a matter of necessity to protect the organism from serious and permanent injury or to preserve life. If her command is obeyed, danger is more or less successfully warded off, pain is eased or ceases entirely, chills stop or lessen in frequency, and the temperature assumes a regular course. Nature is in a better position to cure, and commences at once her work of repair. If the patient rises before the work is done, a relapse is the consequence, and violent chills, high temperature, and sweats with death may follow, or a chronic disease takes the place of the acute attack from which the patient may never recover.

Not alone when the organism is attacked by disease but even in everyday life nature forces us to lie down after a day's work with fatigue and soreness in every joint and muscle. At once we feel the relief of the change of position, stretch arms and legs with agreeable sensations, and pass into sleep—the best condition for nature to free the blood from waste matter and to repair damage done to the cells during the day. The blood-pressure is but little influenced by sleep, yet after lying down it falls, explained by the posture and relaxation, and when waking hours approach and the blood is freed from the waste, the toxins of fatigue, and repair made, muscular tone returns and the blood-pressure rises. It seems almost superfluous to explain the importance of rest in the recumbent posture when we see the ample provisions made by nature to secure it when needed and the serious consequences that with certainty follow a disregard of her warnings immediate and prompt, or slow.

Notwithstanding anyone can see it daily and study the ravages done by wilful neglect or by ignorance—relapse and death after an acute infectious disease has run its course and the patient has passed into convalescence, or premature age, marked by sclerosed and damaged vessels and viscera that are broken down long before their time—there is hardly a person living that will obey this most important of nature's commands when first called upon by fatigue, in neglect of business or pleasure. Only when the warnings becomes more urgent and pain and fever force the patient to lie down, does he rest, and even then it is done grudgingly. Many are the means to frustrate nature's design—coffee, tea, tobacco and alcohol in numberless forms are used to keep up the strenuous life of hard work and pleasure, when rest is peremptorily demanded, and the cry for tonics is heard from morning until night by every physician; newspapers and periodicals bring pages filled with the praise of concoctions that have alcohol and stimulating drugs as their active contents.

Those who are born with a weak constitution and might escape suffering and live up to the fifties die before middle age is reached, and those who spring from a healthy parentage and are favored with a good constitution and ought to be octogenarians, and even reach a hundred, usually die in the early sixties with pneumonia or apoplexies due to arteriosclerosis, nephritis, heart disease, etc.,—in fact, every organ is more or less worn out by that time, and the system is in such a condition as not to be able to stand any additional strain. No physician can add a single day to anybody's life, but he can protect his patient in disease from premature death, from shortening his life, and prolong his usefulness to himself and others and so prevent suffering.

The human body is a complicated mechanism, and length of life and usefulness depend on inheritance, the make-up, the quality of the machine, on wear and tear due to injuries received, including the infectious diseases, and finally on use and abuse of the organism. Each one differs from another and age is but relative. A man may be old at forty and young and useful with many years of active life before him at sixty. It is impossible to compare one man with the other; and to say that people are useless at forty and ought to be chloroformed at sixty is ignoring these fundamental facts.

It is a common sight to observe bookkeepers half asleep at their desks, forcing themselves to work, shop girls and clerks at the counter hardly able to stand up to wait on the customer, and the man of affairs and of brain-work stimulated to work his tired brain, and with it all the constant preaching that work never kills, that work is healthy. More than that, the very young are forced to long hours of work with hardly an intermission of sufficient length to finish a meal.

The injurious effect of neglect is obvious although it has not been explained within my knowledge, and yet the explanation seems to be so simple as to be almost commonplace.

Blood and lymph have to be kept in the upper portion of the body by muscular tone and heart force, and have to be returned from the lower portion by the same means assisted by exercise. All this has to be done against gravity, and it is clear that the amount of energy required for this purpose is limited.

A man of regular habits after a night of dissipation looks old, due to the lack of blood and lymph in the head, and a tired worker after a short while at rest in the recumbent posture feels fresh and ready to work again. After being a certain length of time in the upright position, muscular tone is lost, the heart tires, and blood and lymph follow the law of gravity. This influences the circulation throughout the body, the abdominal viscera become congested, venous pressure rises and arterial pressure falls. A man in this condition may fall an easy victim to disease.

Age demands an after-dinner nap to interrupt the long hours of the day, and the old are forced to go to bed early or fall asleep in the chair. In hot climates, enervating on account of muscular relaxation and lack of tone, the midday siesta is common, and in the towns of Italy and Spain during the noon hours the shops are closed.

Unfortunately we have not learned by this experience, although every chance is taken to put up the legs on anything that comes handy, and lean back in a rocker or tilt the chair to get rest. The day is commenced with a cup of strong coffee to tone up and a cocktail at noon to help over the tiring hours of the day. With this explanation it is easily understood why nature should make such peremptory demands for rest in the recumbent posture when life is threatened by acute disease or overwork and fatigue exhausts the system. "Nature demands her rights;" it assists us in our practice, and the society woman who would not go early to bed or lie down in the middle of the day is ready to

follow our advice when we can convince her that a wrinkled face and sallow complexion will be the consequence of persisting in her habits. The brain and day laborer will yield, finding out that they can do better and more efficient work by following the advice. The explanation appeals to everybody, and I have never failed to have my patients take the advice.

If this simple fact is understood, a great deal of mischief may be prevented by reformatory habits and by people going to bed early enough when feeling ill and not uselessly fighting and disregarding nature's warning in the hope that, in spite of it, the system may get the better of the disease in the struggle for supremacy.

Children should be especially protected. The weak alike with the strong are forced to sit hours in a cramped position at a desk and are punished when unable to furnish sufficient blood for work of the tired brain.

Children and adults who go to bed at night early should take their main meal in the middle of the day, and a sufficient time for rest should be allowed before returning to work. If this is not done it must injure and wear out the strongest organism, not to speak of the weaklings that are forced to follow the same stern rules. Little can be accomplished with tired brains, and it is wasting time and energy of pupils and teachers, causing early breakdowns, nervousness, and disease, to adopt such a routine. In fact, it amounts to a crime toward the young, who are supposed to be benefited by the system.

The child who is unable to follow and to concentrate his thoughts, the weakling who needs rest most, is called lazy, and in the way of punishment is kept in, the hours of work lengthened, and the tired brain forced to do further work by memorizing or copying some useless verse or words. School hours should not be long for the children, and at noon interrupted by a pause of several hours, allowing sufficient time for dinner, rest and recreation, if afternoon hours are found necessary at all.

A difference between the strong and the weak should be made, and the defect of the weaker should be given greater consideration than is now done. In fact, those who usually need less attention are the favored. It is only in recent years that the weak-minded have been separately taught, and the enormous advantage obtained is now well recognized by educators and physicians.

All living organisms require rest: Plants rest in the winter in cold and moderate climates and during the hottest time of the year in the Tropics. Animals hide in quiet places when suffering from disease or injury.

Children waste rapidly without rest, and repair commences and recovery follows when rest is secured. Anything that prevents rest and sleep, may it be pain or worry, excitement, noise, or a simple irritation of the skin, is injurious, and organs that do not find sufficient rest after activity deteriorate. Disease of every organ is the consequence of insufficient rest.

The brain has to be specially considered; it occupies the most unfavorable position in the upright posture, yet the demand for blood is constant. Many forces with simple though complicated contrivances are constantly at work to keep its blood distribution perfect. Muscular tone and heart force are the most important factors, and muscular contractions, exercise, cause the blood to return to the heart from the lower portions of the body and thereby assist to keep up a perfect circulation in the upper part. If the tone of the skeletal muscles and that of the vessels be suddenly inhibited by fear or temporarily destroyed by shock, the blood will drop, owing to its weight, into the dilated and supported vessels of the most dependent parts of the body. The flow of blood through the brain will under these conditions become sluggish—that is, so long as the body is in the erect posture. To restore a fainting person, the head must be lowered. It is not the volume of blood but the velocity of flow that is altered in the brain by changes in the general circulation.

Posture influences blood-pressure but little; the circulation has to be kept practically the same in any position, and that is done by blood-pressure. The cells of the body demand blood at all times, and the organs become turgid when at work.

When in the recumbent posture far less work is required to keep the blood-pressure normal, and when assuming this position the blood-pressure sinks a little, and as pointed out before, rises again toward morning; when waste has been removed from the blood and repair has been made, tone returns to muscles and heart and the rise follows. Similar to body temperature, the average blood-pressure remains always the same, though gradually rising with advancing years. Its daily fluctuations, however, are far greater than those of body temperature.

The circulation of the brain seems to depend entirely upon general blood-pressure, which would explain the rise when the

higher faculties are engaged. Excitement, active mental work, and worry increase it considerably. In practice such variations may be noticed in nervous subjects when the blood-pressure is measured at the beginning of the examination and controlled at the end. A variation of several mm. mercury is often found.

The fine and complicated mechanism to regulate blood-pressure is mainly located in the splanchnic area. The capacity of the abdominal vessels is so large that they are capable of receiving all the blood of the body, and a man may bleed himself to death in his own vessels. The splanchnic nerves supplying this vast area are easily influenced by any cause acting upon the skin and every sensory organ, and will cause prompt dilatation of the vessels, when blood-pressure rises to a dangerous point. The skin with its vast supply of vessels is another important factor in regulating blood-pressure, and its close connection with the splanchnic area draws the blood from one large reservoir into the other upon instant demand.

REST IN DISEASE

The acute and chronic diseases accompanied by fever and pain must be treated by rest in bed.

An acute disease or an exacerbation of a chronic disease is usually preceded and accompanied by symptoms of intoxication and of a disturbed circulation, the blood becomes impregnated with toxic products of pathogenic microorganisms that have entered the body, or with an excess of waste due to organs refusing to function, causing rise of temperature, general malaise, headache, nausea, dizziness, cough, loss of appetite, soreness and pain, indications that the defences of the organism are broken down and that the disease is getting the upper hand. If at that time, the patient is placed in bed and complete rest secured, the circulation is eased, the work of the heart against gravity ceases, and congested organs empty themselves, the capillaries of the skin, surrounded by a layer of warm air, open and draw the blood to the periphery. A warm enema, a hot and prolonged mustard foot bath and, if indicated, a counter-irritant over the base of the lungs or over the abdomen may be added. This changes the conditions, and the organism is thus placed in a favorable position to fight the disease. The blood current slows and flows to every nook and corner of the body. Toxic substances are neutralized or removed, pathogenic micro-organisms are destroyed,

tone restored to the whole system, danger removed, and repair commences before the disease has had time to spell its name.

The first warning is unfortunately rarely taken, because even under unfavorable conditions the system remains victor in the fight, and after a few days of slight suffering, without interruption of the usual business or pleasure, the patient is apparently restored to health. If a cure has not been thorough, the resisting power of the organism remains impaired, less ready to overcome a new infection. Exposure to infection is constant. A slight dyspepsia, a little cough, or an occasional headache, disturbances of the bowels, etc., may be the beginning of a serious chronic illness. A simple cold poorly treated may be the beginning of a chronic tuberculosis or an acute lobar pneumonia, or quinsey, may be followed by articular rheumatism. A sour stomach neglected may cause ulcer of stomach or duodenum, just as a poorly treated case of syphilis may end in tabes dorsalis or paresis, or a curable case of acute mania or paranoia may pass into incurable insanity, if not given early and proper treatment. It is prevention that protects. Whenever the fight is commenced between disease and the system, no one can predict the outcome, and it is reckless to trust to good luck and take chances of serious illness and perhaps death, when this could be easily avoided by a few days in bed and rational treatment at the beginning. Even the most careful examination will not reveal the power of the patient to resist the amount of intoxication and virulence of bacilli when disease commences. If the first light symptoms are seriously taken, we will in many instances ward off danger.

Even when the first symptoms are overlooked, serious results may be warded off. This depends on many conditions. The amount and virulence of bacilli and toxins that have entered the body, the state of blood and organs and the resisting power of the system against the particular infection, and inherited or acquired weakness or strength to resist it—all these are important factors. I have seen pneumonia aborted. This is pain in the side, chill, high fever and crackling rales over one lobe disappear and acute infections cured in a few days before a positive diagnosis could be made. If the disease is already well established, absolute rest in bed is necessary till it has run its course. This must be modified by treatment. Usually not until convalescence has well commenced should any attempt at exercise, beyond a gentle massage, or alcohol rub be made. All acute infectious diseases tax the heart more or less disturb the circulation, change the

composition of the blood and weaken the heart muscle, and in spite of rational treatment, some fibers are probably degenerated in every case. Endocarditis is not rarely a sequel to infectious diseases and myocarditis is frequent. It is not safe to allow the patient to sit up in bed or to get out of bed to use the chamber till the heart has become steady, when a changing from the recumbent to the sitting posture may be made. If the heart commences to beat rapidly and to flutter when such a trial is made, it is a danger signal and the patient must be kept in the recumbent posture till this sign has disappeared. If heart sounds are weak the heart is weak, and the second pulmonary sound has to be constantly watched in pneumonia, an indicator of the strength of the right ventricle, which is overburdened with work in this disease. If the accentuation of this sound disappears, it is a sign of beginning heart failure and the danger is great. Full stimulation is then indicated to keep up the heart till the crisis has passed and the heart has regained its strength. It is true that stimulation may be compared with beating a tired horse, but it also means more blood to the heart muscle, and time gained to assist Nature to improve the existing conditions.

In any case of prolonged rest, massage and passive exercise must be commenced as soon as possible, without disturbing the healing progress, to assist the circulation. Active exercise must gradually be resorted to as convalescence progresses, though for a long time rest must be paramount and exercise moderate.

THE GASTRO INTESTINAL DISEASES

A rest cure has been universally adopted in the treatment of ulcer of the stomach, largely due to the work of Ziemssen and Leube in Germany, who developed it to a special system though before them Cuveilhier in France and Wilson Fox, Forster and Williams in England had employed and recommended the rest treatment in this disease. It is readily understood that an external ulcer has to be treated by rest and that it is impossible to secure a cure without it. The laity will see this, whereas it seems not necessary in the eyes of many physicians when it comes to the treatment of ulceration of the gastro-intestinal tract. That this is radically wrong does not need further consideration. A wound cannot heal as long as it is constantly pulled upon and irritated and an external ulcer is carefully protected and kept quiet. It is far more difficult to heal an ulcer of the stomach and

intestines than an external wound, as it is next to impossible to secure absolute rest in this condition. The peristaltic action of the gastro-intestinal tract prevents this most desirable feature. "The condition of the blood, anaemia and chlorosis form frequently a pre-disposition for ulcers and the acid of the gastric juice a constant irritant."

It is, therefore, more necessary to procure rest, as far as possible, to the gastric ulcer, than it is for an external wound. Of course, many chlorotics and anaemics do not suffer from gastric ulcer and hyperchloridia does not always mean this condition. Anaemia, chlorosis and hyperacidity form a basis upon which the ulcer may develop. A blow, burn or some injury inflicted upon the mucous membrane by a hard piece of food, or a seed is usually the direct cause. The resultant ulcer remains, though the cause has long passed when the patient comes under our observation.

To heal such an ulcer, the first indication is rest in bed. In the correct treatment of gastric ulcer this measure is adopted as a matter of fact, though it is often difficult to induce the patient to interrupt his usual occupation and to lie down for weeks, when he is free of fever and pain. If we can impress upon a patient that he is suffering from an ulcer and that, when in the upright position, Nature is handicapped to cure, we will likely succeed to make him lie down.

This procedure is not alone sufficient to secure rest to the ulcer. To make that rest, as far as possible, complete, we have to see that the wounded surface of the stomach is not irritated, and that is only possible if feeding per os is discontinued and rectal feeding adopted instead. This will remove the constant irritation caused by the hypersecretion of the gastric juice, which is usually present in peptic ulcer. Though such a measure is the only one that can secure perfect rest and the best to facilitate healing, it has been tried only in recent years and, of course, with success. Formerly this measure was adopted only after severe hemorrhages. At present it is the custom to commence the rest treatment with at least a few days of rectal feeding, and in severe cases and those of frequent relapse, some have relied on rectal feeding from ten to twenty days successfully, when all other methods of treatment had failed. The most severe paroxysms of pain stop, vomiting ceases and repair commences. During hemorrhages this is the only rational method, but, as pointed out, the best and safest in all cases. It does not make any difference

whether the patient suffers from a fresh or an old ulcer, though the best results may be expected in the former case. When the injury is new, the tendency to heal is greater.

Thirst has to be satisfied by small pieces of ice allowed to melt in the mouth, the water to be expectorated. Frequent mouth washing should be resorted to. This treatment, the effect of which is to improve the general circulation and to secure rest to the affected part, is materially assisted by hot poultices or Priesnitz bandages applied to the stomach, and other means to locally influence the circulation.

The next step consists in proper diet, to be commenced not before four to eight days and longer according to indications. Mental rest is of importance. Mental activity disturbs the circulation. Complete seclusion is rarely necessary, it depends on the temperament of the patient. The physician is the best judge when to adopt this measure.

Frequent and prolonged visits from outsiders are always injurious and should be prohibited. This is often difficult as both patient and relatives rarely can see the necessity, and in the country especially it is the habit of people to flock to the bedside of the sick.

The severe and toxic forms of acute gastritis, as well as the severe forms of an inflammation of the stomach, are best treated with rest in bed and rest to the organ on a plan outlined for treatment of gastric ulcer. A thorough and rapid healing will be the consequence if such a plan is adopted, though it may be difficult in many instances, to persuade the patient to submit to it. It is easier to treat children who frequently suffer from gastritis, due to an overloading of the stomach with sweets, fruit, not ripe and not clean, and other indigestible articles of diet, and to insist that these measures be adopted. Complete rest in bed and dietary measures, rest of the organ, days after the pain and loss of appetite have passed, is recommended, to give Nature a full chance to repair the injury.

Carcinoma of the stomach, as well as all chronic affections of this organ that are not accompanied by fever, require intermittent daily rest to secure better nutrition. Hours of rest after the noon-day meal and an early going to bed, that is, never allowing the patient to be longer than a few hours in the upright position, either sitting or standing, relieves heart and vessels from strain, eases the general circulation, causes better assimilation of the

food and improves local conditions. Fever patients must be kept in bed.

Nothing can be added to the rest treatment of liver, pancreas and intestine. The acute diseases of these organs have to be treated with prolonged rest in bed, and the chronic forms with rest at intervals when indicated. With this has to be combined the rest to the injured organs, that is, a diet avoiding irritating substances to procure rest to the organ as much as possible. It is fortunate that in all cases where prolonged rest in the reclining posture is indicated, this can be carried out in the open air and that when needed the sun bath, local or general, can be added to the rest treatment of these patients.

Just as in the treatment of patients suffering from peptic ulcer, local applications in forms of poultices, warm Priesnitz bandages, thermophores are indicated in these cases to improve the local circulation.

DISEASES OF THE LUNGS.

The treatment of the diseases of the lungs with rest is of great importance and has to be carried out on a plan outlined for the acute and chronic infectious diseases.

As mentioned, in any disease, with the exception of the acute stage of the infectious fever, rest in the open air offers great therapeutic advantages and makes such a treatment more pleasant to the patient. It is, therefore, especially well adopted to treat consumptives who are in the last stages with this method. When fever and sweats weaken the organism and destruction of lung tissue has progressed they need rest in the reclining posture primarily.

All sanatoria, especially those for consumptives, should be selected to permit such a treatment. The prognosis will be more favorable if patients can be treated with rest in the open air under a shady tree, surrounded by grass and flowers, with a view over the country.

This factor is not valued enough by profession. We still find hospitals and sanatoria located in the midst of the hustle and bustle of our large cities, with barely a tree or a grassplot in sight and smoking chimneys obscuring the sun.

DISEASES OF THE HEART

Life of the human organism depends largely upon the equilibrium existing between arterial and venous pressure; if

this is perfect, nutrition is perfect and all waste is readily removed. If arterial pressure fails, venous pressure rises, and if persistent will finally result in the dissolution of the organism.

Etiology and pathology of the diseases of the heart and circulation teach that as soon as this equilibrium is disturbed, we have a complex of symptoms at once characteristic and remaining the same no matter what the primary cause may have been. The direct and final cause is always the same, breaking down of the heart, due it may be, to a valvular lesion or an obstruction in the pulmonary or systemic circulation. Trouble once established, the heart answers immediately with greater work and consequent hypertrophy, the demand to compensate. As soon as the heart ceases to compensate for the damage, venous pressure rises and arterial pressure falls. The pulmonary system then becomes congested and the engorged systemic veins are unable to pour their contents into the heart. A continuation of the process tears the alveoli and allows serum to pass, causing emphysema and edema of the lungs. The engorgement of the systemic veins creates at the same time an intense hyperemia of all the abdominal organs, the stomach, intestines, liver, spleen and kidneys. Edema of feet and ankles follows. Places where in health the circulation is weak and where under these altered conditions the masses of blood contained in the engorged large veins, press heavily upon the capillaries. Serum passes into the tissues, and the lymph vessels, unable to empty into the overfilled venous system, cease to drain.

Symptoms, the expression of pathologic conditions that threaten life, appear sooner or later after a valvular lesion has been established or an obstruction in the pulmonary or systemic circulation has become permanent. The heart answers the demand for more work with hypertrophy, and as this can only be carried to a certain point, malnutrition of the heart muscle and myocarditis follow,—a time comes when a slight exertion causes the compensation to break. Shortness of breath and palpitations are generally first noticed; the blood is poorly aerated in the congested and changed capillaries of the lungs; the alveoli are torn by the engorged vessels and damaged and encroached upon by interstitial tissue growth. The face becomes cyanotic, blueness of the lips and finger tips is marked. The pulse formerly feeble becomes irregular and palpitations are more frequent, due to frantic efforts of the heart to empty its chambers. Perspiration is increased and in contradistinction to the suddenly developed overaction of the skin, the urine is diminished in

quantity, is of high specific gravity, highly colored and contains a sediment and albumin, the typical urine of stasis.

A bronchitis accompanies the changes that take place in the lung-parenchyma, the intense passive hyperemia causes catarrhal inflammation and the patients are shaken with violent coughing spells, nature's efforts to rid the bronchi of a profuse, serous, slimy and frequently bloody secretion.

The conditions existing in the lungs—torn and changed alveoli, congested venous capillaries and clogged up bronchi, against which the diseased and weakened heart batters, give rise to the distressing spells of dyspnea, so well known to every practitioner as cardiac asthma. Every organ in the body suffers in proportion; chronic gastritis, constipation, diarrhoea, and congestion of the liver and cirrhosis occur as the result of the obstructed return of the blood from these organs into the vena cava. The engorged liver and spleen and the distended stomach, even after a light meal, pressing from below against the diaphragm, are additional causes to increase the dyspnoea. Bile is changed in composition and reabsorbed by the blood, giving an icteric hue to the skin.

The congestion of the kidneys causes pains in the lumbar region and characteristic urine (reduction of quantity, high color, high specific gravity, a sediment, albumin and sometimes casts). Further progress of these disturbances, leads to fatal result—directly due to heart paralysis and dilation and secondary nephritis, general anasarca, hydrothorax, hydropericardium and cerebral edema; whereas, in the former, fatty degeneration of the heart muscle, chronic myocarditis and sclerosis of the coronaries cause it, though a sudden dilation of the heart, due to the inability to force the constantly growing mass of venous blood into the pulmonary circulation, may occasionally cause a healthy heart muscle to fail.

There is not a disease nor a diseased organ that makes the dependence of health upon a perfect circulation and the necessity of rest so clear and evident as the disease of the circulatory system itself. As soon as the heart weakens, due to any cause, disturbed circulation and with it disturbed function of every organ, faulty secretion and excretion and impure blood is the consequence, with distressing symptoms.

A patient who suffers from a diseased heart or diseased vessels, must be taught that his circulatory apparatus is damaged. It is unnecessary and dangerous to frighten such a patient and it

is sufficient in many instances to speak of a weakening of the circulatory system, the main object is to teach him to take care of and strengthen the weakened organ. We know strong hearts and weak hearts, elastic and unelastic vessels, even in youth, and apparent health, due to inheritance, and speak of strong and weak constitutions. In these cases it is just as important as it is in advanced disease to realize that there is but a limited supply of power and that care should be taken to keep it.

The physician can diagnose a deficiency inherited or acquired, but it is impossible to say how much that is, and it depends on habits and occupation whether the circulatory system is able to supply the demand made up it without injury.

The patient can tell fairly well from subjective symptoms, especially from fatigue or exhaustion, that the system demands rest. This is usually not taken as a warning and stimulants are used, alcohol and tonics in various forms, to force the system to supply the demand. Soon a habit is established the organism becomes accustomed to overwork and stimulation, and day after day minute structural changes go hand in hand with increased stimulation, until the system gradually requires more and more in order to keep up the same amount of work. This refers to all toxic substances introduced into the body. The organism acquires an immunity; bodycells learn to live in the juices saturated with toxins, and it does not matter whether these are tobacco, alcohol, coffee, tea or drugs. It is a defensive measure of the system against foreign invasion.

A valuable therapeutic rule to be derived from this is never to give any medicine continuously, but to do so at intervals. This will cause the loss of acquired immunity. This can be easily done as we have a large number of drugs to select from if a certain effect has to be kept up for some length of time. In a number of diseases, especially in syphilis, this rule has been long followed; the treatment with mercury and the iodides at intervals has been the practice. A similar procedure is now followed with Ehrlich's arsenic preparation. Quinine in malaria for two or three days in large doses to saturation to be repeated every seventh day, has been the every day custom in malarial countries.

It is of paramount importance to teach the patient to listen to Nature's demands for rest. This is an absolute necessity with a weak or diseased system, and a valuable protective in health. This seems easy enough at first sight, yet it is the most difficult problem the physician encounters. Patients have to keep up

work in spite of what we have to say. Not alone their own life, but that of their families, their wives and little ones depend upon their daily work. In these cases we have to advise the best we can and modify treatment to some extent in order to put off the breakdown that is bound to follow. Easier work, if that is possible, intermediate rest in the recumbent posture, especially at noon, after the main meal, when blood pressure is high, and the blood is central, will relieve the overtaxed heart and vessels and restore tone even if rest can be taken only for half an hour. Early bedtime is imperative. It has to be impressed upon the patient never to be too long in the upright position, standing or sitting. Walking or moving around during work is less taxing as the muscular contraction facilitates the return of the blood to the heart.

If symptoms of heart insufficiency appear, such as headache, indigestion, cough, rheumatic pains, disturbances of the bowels, shortness of breath, dizziness, slight edema of feet and ankles, etc., it is necessary to put the patient to bed until the compensation is restored. If the compensation is completely broken, and the serious symptoms—dyspnoea edema of feet and ankles and the characteristic urine of stasis—appear, there is only one method to adopt. The patient has to be kept in bed before any other treatment can be commenced with hope of success. At this stage the physician finds but few objections, nature forces her demands and there is no ease to be had except in that position. If the disease has progressed to orthopnea, this valuable measure is useless. Even in that case the legs should be supported to ease the return flow in the veins and lighten the burden of the diseased and tired heart, and the recumbent posture assumed as soon as possible. In hot and tropical climates and the warm months of the moderate climates, the symptoms of heart insufficiency will appear sooner, on account of the absence of the tonic effect of cold air.

NEPHRITIS, ACUTE AND CHRONIC

Bright's Disease is a constitutional disease. In every instance an intoxication of some kind is the cause, the toxins of the micro-organism of the acute and chronic infectious diseases and the toxins of diseases of metabolism, gout and diabetes, and certain poisons ingested. These poisons carried by the blood to the kidneys, there giving rise to the disease. The character-

istic etiological feature makes it clear, why next to the kidneys, the heart, vessels and liver have to suffer, *though not any organ in the body escapes injury*. The perfect condition of all depends on pure blood and a normal circulation. A differentiation, except in typical advanced cases, is not always easy to make. The acute parenchymatous form may gradually pass into the chronic form, and this into the sclerotic kidney. The exacerbations of the chronic parenchymatous and interstitial nephritis may be mistaken for the acute disease, and the congested kidney of circulatory disturbances resembles acute nephritis.

Acute nephritis accompanies or follows in the wake of the infectious diseases, though the absorption of toxins produced in chronic diseases of the digestive tract, the ingestion of certain drugs, exposure and chilling of surfaces may cause it. All anatomical elements may be involved. The exudation is excessive and glomeruli and tubules are choked with debris. If the interstitium is involved, the danger that the disease passes into chronicity is great. The patient presents a typical picture, the face is bloated, the color pale and sallow and the general anasarca gives a waxy appearance. The excessive edema is due to the injured vessels, to heart weakness and to the inflamed kidney, pronounced in cardiac disease, as is often the case, complicates the trouble. Every function is interfered with dyspnoea, complete anorexia, nausea and vomiting, diarrhoea, headaches, convulsions, paralysis, epileptic seizure and amaurosis due to cerebral edema, some or all may be present in such a general intoxication. The urine is diminished in quantity, is of dark color, of high specific gravity, contains a large amount of albumin and the sediment contains casts of every description, usually blood corpuscles and epithelial cells.

According to severity the process may last from a few days to months.

The clinical picture of an acute exacerbation of the chronic and interstitial forms, does not differ from that of acute nephritis, and the two can be differentiated only by the history and the changes that have been produced in heart and vessels, lungs, liver and spleen. If acute nephritis passes into the chronic forms, the symptoms become gradually less marked, edema and albuminuria decrease, the scanty urine changes with copious and frequent urination, and pale face, the puffy eyelids and the edema of feet and ankles persist. The urine contains albumin, fat, epithelial cells, granular and frequently waxy casts.

The contracting kidney is by far the most frequent, and the causes that induce it are numerous. Either hard work or exposure, or a life of ease and luxury, may cause it. Mental labor and anxiety, gout, alcoholism, lead intoxication, malaria, lues and diabetes are also predisposing causes. As in all other forms of Bright's disease, the toxic substances produced by these various causes are directly at fault. High arterial tension, venous congestion and interstitial tissue growth, with consequent destruction of parenchyma, are its main pathological features. It is a very serious disease and common one. It is a most frequent cause of death—if not directly, through intercurrent diseases. Its cause is manifold, its onset insidious, its progress is slow and steady. Interstitial nephritis is found in all walks and stations of life, both sexes are subject to it and there is not a disease, that, with such steadiness and certainty, undermines the general health and lowers the resisting power of the body with so little warning. Not an organ in the body is spared, and changes are wrought daily and hourly, the system adapting itself to these changes as they progress, so that the patient feels only occasionally, and in the beginning very slight disturbance of general health, for which he finds ready relief by enforced rest and the drugs dispensed to him. When finally a thorough examination is made, and an advanced stage of the disease is discovered, sometimes accidentally, warnings may be disregarded and further valuable time lost, till apoplexy, a pneumonia or cardiac failure, due to an advanced myocarditis, closes the scene. This peculiar course of the disease is readily understood when we consider life led under normal conditions. Even then toxic substances constantly retained in the blood, may cause in course of years, thickening of vessel walls and atheromatous degenerations, cardiac, hypertrophy and myocarditis, cirrhotic processes in lungs, liver and kidneys. The kidney of the aged differs but little from the kidney of the interstitial nephritis, and the changes are produced even in normal conditions with comparative rapidity. It has been said that after the age of forty all kidneys are diseased. That the kidneys should suffer most, we understand, if we remember that these organs practically consist of a mass of tubules, surrounded by numberless capillaries, incessantly filtering toxins ingested and the waste of metabolism constantly formed.

The most frequent causes of death in interstitial nephritis are the most common causes of death of the aged, pneumonia, apoplexy, or myocarditis, though, of course, any trifling cause

may break down a worn out organism. Interstitial nephritis is a premature old age and intelligent treatment is the primal measure to ward it off.

The kidneys are the most important organs of elimination, and any failure to function means retention of toxic substances in the blood. Impurity of the blood is soon followed by circulatory disturbances and structural changes in every organ of the body. Purity of the blood and a normal circulation, the fundamental conditions of good health, fail.

The treatment of acute nephritis is, first of all, preventive. During an infectious disease, and after the disease has run its course, the kidneys have to be watched and the urine has to be frequently examined. Pure water, vichy, milk or buttermilk must be freely administered to flush the kidneys, and drugs that irritate them should be given with the greatest caution. *A regimen that saves the organs, and keeps them at rest has to be adopted. During this time the patient should be kept in bed and in the recumbent posture, and absolute rest in bed is the treatment after the disease has been established, no matter how mild the case.* There is no drug known that exercises a beneficial influence upon the process. Thorough elimination by skin, bowels, lungs and kidneys, and rest to the organs, secured by suitable diet, are the indications.

Rest in bed lightens the burden of every organ and increases elimination and a suitable diet saves the kidneys. The treatment of the chronic form does not materially differ, though rest and diet must be modified to conform to less vigorous demands. The treatment must vary according to the stage to which the disease has progressed. Knowing that the onset is insidious and slow and that it takes months and years to establish changes that interfere with normal health, it becomes of the highest importance to make an early diagnosis and not to wait for symptoms that already indicate an advanced state.

The first indication in all cases is rest. Save the organ by preventing or limiting the production of toxic substances by a carefully chosen diet and rest in the recumbent posture, if possible in the middle of the day, combined with early bedtime to shorten the hours in the upright position.

THE NERVOUS DISEASES

There is a large class of patients suffering from the functional neuroses, hysteria and neurasthenia, that are especially benefited by rest.

Weir Mitchel reports a case in 1874 that suggested the now famous treatment of rest, feeding, massage and electricity, to him.

(*Journal of Mental and Nervous Diseases*, June, 1904, pg. 369).

"Mrs. G. of B., Maine, came to see me in the month of January. She was a lady of ample means, with no special troubles or annoyances, but completely exhausted by having had children in rapid succession and from having undertaken to do charitable and other work to an extent far beyond her strength. When I first saw this tall woman, large, gaunt, weighing under a hundred pounds, her complexion pale and aeneous and heard her story, I was for a time in a state of therapeutic despair as usually fell upon physicians of that day, when called upon to treat such cases. She had been to Spas, to physicians of the utmost eminence, passed through the hands of gynecologists, worn spinal supporters and taken every tonic known to the books. When I saw her she was unable to walk upstairs. Her exercise was limited to moving feebly up and down her room, a dozen times daily. She slept little and being very intelligent, felt deeply her inability to read or write. Any such use of the eyes caused headaches and nausea. Conversation tired her, and she had by degrees accepted a life of isolation. She was able partially to digest and retain her meals, if she lay down in a noiseless and darkened room. Any disturbance or the least excitement, in short, any effort caused nausea and immediate rejection of her meal. With care she could retain enough food to preserve her life and hardly to do more. Anemia, which we had no accurate means of measuring, had been met by half a dozen of forms of iron, all of which were said to produce headache and generally to disagree with her. Naturally, enough, her case had been pronounced to be hysteria."

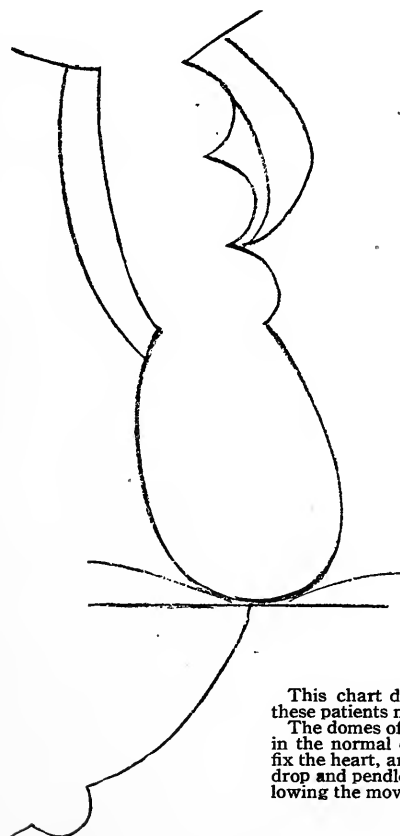
I have quoted this case fully as it is typical and upholds my contention. The patient tells the story we hear from most of such patients. I have treated many and years ago I was struck with the usual association of splanchnoptosis with these nervous symptoms, so that I have come to look for this condition when I come across the symptoms of hysteria and neurasthenia. The following case will illustrate the above:

Mrs. B., twenty-eight years; has no children and has had no miscarriages. Father and mother living, healthy; the mother is nervous. Patient has had measles, whooping-cough, malaria, typhoid fever and appendicitis, and states that she has always been in delicate health, but well until about six years ago. She

then commenced to suffer occasionally with severe paroxysmal pains in the right side, though she would constantly have a feeling of discomfort and soreness in that region. In the summer of 1901, she commenced to suffer from indigestion and flatuency after eating; the character of the food did not make any difference, everything would disagree. She was then treated by a specialist for ovaritis and *appendicitis*, without obtaining relief; returned to her home and improved, until 1903, when the pains again became severe and she had her *appendix and ovaries* removed, and the stomach which was found prolapsed, raised and fixed. The gall bladder was also removed. No gallstones were present. After the operation the pains became milder, but shortly after, again returned. When I first saw her, she complained of the same soreness and sharp pain in McBurney's point and around the navel, and also backache, which she had had for years. She is deeply depressed and cries frequently. Her face expresses despondency. She worries constantly about herself, examines her rectum frequently and feels greatly worried if she finds mucus in stools, as is often the case, or if she has not had a passage. Patient is easily irritated and fatigued, afraid to walk or do anything. Her appetite is good, digestion poor, she feels full after a meal and belches loudly. She has never vomited, and states that she frequently tried to relieve herself by putting her finger in her mouth, but cannot vomit. Patient is five feet, eight inches in height, thin and pale, muddy skin, and weighs one hundred and twenty-five pounds. Her weight has been always between one hundred and ten and one hundred and twenty-five pounds. Chest organs normal, liver and spleen normal, and right kidney can be palpated full length; splashing is present over the stomach area, lower curvature is a hand's breadth below the navel. Contents very acid, excess of hydrochloric acid, undigested food, and some mucus. The urine is normal. The stools are formed and occasionally contains flakes of mucus—Infantile uterus. This patient presents the neurasthenic type, with hypochondriacal sensations and anomalies of growth—slender figure and infantile uterus. It is interesting to note that the usual complexity of symptoms, though temporarily relieved after the operations, returned after a few weeks, to stay.

It is an affection of common occurrence, causing so many functional disturbances of the abdominal organs, of the heart and lungs, and of the nervous system, frequently presenting a variety of symptoms imitating organic lesions, that it will be always of

the greatest importance to the general practitioner to carefully study the condition. With prolapse of the stomach we may find the kidneys displaced, especially the right kidney, the intestines, especially the transverse colon and iliac flexure, the liver, the uterus, and occasionally, though rarely, the spleen. A displaced movable heart is frequently found.



This chart demonstrates well why these patients need rest to recover.

The domes of the diaphragm, which in the normal condition support and fix the heart, are depressed, allow it to drop and pendle from side to side, following the movements of the patients.

VISCEROPTOSIS AND DROP HEART

Lersch "Drop" Method of Percussion Used

Mrs. H., examined November 21, 1915, housekeeper, 45 years of age, mother of four children. She complains of severe digestive disturbances, of frontal headache and pain end of spine (pseudo coxalgia). Patient is 5 feet 8 inches high and weighs 117 pounds.

Pulse regular 90, arteries contracted, not palpable after pressure.

Blood-pressure 105.

Lungs free.

Heart soft systolic blow at apex.

Splashing over stomach four hours after light breakfast (coffee and toast).

Liver border palpable, hard and sharp.

Kidneys movable.

Urine nothing abnormal.

Stomach contents after test breakfast general acidity with particles of toast, some mucus and colorless liquid.

The disturbances of the nervous system, those of hysteria and neurasthenia are always present. Such a symptomatology, with the history of good health up to marriage, frequent childbirth and emaciation, often allow a diagnosis almost invariably confirmed by an examination. The nervous symptoms are, therefore, of great interest, and as the patients frequently present hysterogenous zones, the disease is diagnosed as hysteria. Women are most frequently the sufferers, and ovarian pain and backache are hardly ever absent. The psyche is changed, the patients show great instability of temper so characteristic of hysteria, are easily irritated, and easily fatigued. Susceptibility to suggestion and forgetfulness, or better, lack of attention, are associated with a train of various other hysterical symptoms. Hot flushes and chilly sensations (nervous chills) dermographia, globus, cramps, tremor, pressure points of pain in the usual locations, headaches, hemicrania and the clavus hystericus, exaggerated reflexes, absence of uvula reflex, and diminished or absent corneal reflex, analgesia and hyperesthesia, palpitation of the heart, and attacks of asthma, may all be present. Pulsation of the vessels, especially of the abdominal aorta, is always an object of observation and worry to the patient. One of my patients called it her "second heart". All may be found and to such a picture we may often add an inherited tendency of the trouble. The mother or grandmother, or some other member of the family may be afflicted like our patient. Symptoms of neurasthenia are usually mixed with those of hysteria. The patients are depressed, complain of dizziness, headache and sleeplessness; of pain everywhere; of hypochondriac sensations, etc. These are all important symptoms and will call attention to the real trouble. The down-

ward displacement of the stomach is the usual form, though occasionally we find it in the vertical position. The displacement of the stomach causes digestive troubles, and these vary in character, are rarely alike in two patients, and even in the same patient, they may change from day to day, though on the other hand a certain complex of symptoms may be lasting, in spite of treatment for days, for weeks and for months. It is a clinical picture of the digestive troubles of the neurotic, the hysteric and the neurasthenic, not that of any organic disease, though it may, as these so frequently do occasionally simulate the latter to perfection.

Pressure and fullness after eating, a ravenous appetite, changing to complete anorexia, a good appetite with fear to eat, may be seen. Heartburn, water-brash and regurgitation of food, and paroxysmal pains, probably due to spasms of the abdominal vessels, though severe pain in the abdomen must first of all suggest a serious lesion.

Vomiting of food or of gastric juice mixed with mucus occurs, but it is rare and some of the patients state that they cannot vomit at all. Loud belching of colorless gas (air due to cribbing), swelling and tightness of the abdomen, sometimes after eating, sometimes with an empty stomach, are also symptoms and sometimes the swallowing of water may cause severe pain and discomfort. Just as the chemical composition of the food happens to be, food may relieve or cause it. As it is to be expected the intestinal functions are always disturbed, flatulency and constipation are common, though diarrhoea may be found alternating with constipation. Large flakes of mucus are often passed, though their passage does not cause pain in every instance. One patient of mine passed for weeks at a time masses of jellylike mucus.

It is especially this class of patients that suffer from eye strain, and whose troubles are frequently lightened and sometimes entirely relieved by the correction of this fault. The eyes are used from the time we rise to the time we retire. The muscles for near sight weaken rapidly with advancing years, having been used only extensively with the introduction of printing and of electric and gas light and, therefore, not well adapted to the growing task. To function well the eyes requires a great deal of bloodsupply, and under these changed conditions and disadvantages with an additional defect of astigmatism, it can be readily understood that it must materially increase the disturb-

ances of the cerebral circulation and may alone be the cause of the troubles and symptoms complained of.

Visceroptosis is usually associated with an enlarged thymus. Some enlargement of the thyroid is sometimes seen and occasionally exophthalmos or bulging of one eye, corresponding to the side of greater enlargement and dullness, and the symptoms of exophthalmic goiter resembles the symptoms of thymic enlargement. Tachycardia and tremor are usually symptoms of both, though the heart beats seldom more than 120 per minute and a slow pulse may be found. The pulse is small and the arteries, mostly contracted, may beat visibly, especially the carotids, and sometimes pulsation between the sternoclavicular joints can be seen. The appearance of the skin is sometimes normal, at times brilliant, and occasionally pasty. The heart sounds are loud and the apex heaving. Irritation and irritability of temper, forgetfulness or rather loss of attention, coupled with hysterical stigmata, and the various visceral disturbances, easy fatigue of body and mind associated with normal muscular strength are often found. Underweight is more frequent than the normal or overweight. Hyperidrosis is frequent and sometimes local, especially in the palms of the hand. Increased urination and palpitation and disturbances of the stomach and intestines are almost always present. That the symptoms are due to thymic enlargement seems to be probable. The large amount of blood retained in the organ, increased by fright, anger and exertion, which cannot escape in the upright position, stimulates the fibers of the sympathetic and vagus; this and the disturbances due to pressure upon the large vessels, esophagus, trachea and nerves seem sufficient to explain the symptoms. Heredity is another factor that finds easy explanation; and so also the measures adopted to treat the neuroses, *especially the rest cure*, favor the emptying of the organ of the surplus blood and lymph.

The differential diagnosis is not difficult to make. The ever present nervous symptoms and the area of dullness, clearing up on change of position, make it an easy task to diagnose the affliction. Finally the action of the Roentgen rays and especially of the high-frequency current causes a considerable contraction of the gland. After an application of a high-frequency current for five minutes a large gland will diminish considerably around the margin. This fact will differentiate it from any other cause that might give dullness on percussion over the top and to the side of the sternum, such as a tumor in the mediastinum, enlarged glands,

aneurysm, or dilation of the aorta. The application of this form of electricity given without any danger, will prove a valuable means of treatment; to some extent, the effect is permanent.

The following case is interesting and to the point:

"Miss E., 18 years of age. For two years nausea and occasional vomiting. Discomfort in the epigastrium, fullness and pressure after eating, appetite poor, bowels constipated. Loss of weight. Patient very nervous, hysteric, dilated pupils, tremor manuum, exaggerated reflexes. Uvular reflex absent. Right kidney palpable. Lower curvature of stomach at naval, splashing over the whole area. Arteries contracted. Pulse 90. Large area of dullness over top and to both sides of the sternum, especially, as usual, to the right."

I have dwelt at some length on this subject to show that all these cases have a physical basis which has to be corrected and that rest is often the only remedy to cure, and further, on account of the large number that suffer without finding relief and drift from physician to surgeon and back to the physician to finally land with the Christian Scientist, or the Osteopath.

The number of these patients are so great as to make up far more than one-half of all that come for relief to the nerve specialist, the stomach specialist and the general practitioner. Besides, we find a large number of them, with the surgeon and the eye, ear, nose and throat specialists.

Organic diseases may complicate this condition. Though there may be no immediate danger to life, the constant disturbance of the circulation and function of the organs and the usually resulting waste will finally cause serious troubles, not to speak of the discomfort and suffering of these patients and their surroundings.

In the discussion of these patients we are usually left under the impression that the rich, who have time and leisure to pay attention to their ailments are the sufferers. According to my observation, it is just the reverse, the poor suffer far more intensely than the rich. It is true that the financially well situated have time to attend to their ailments, and that the poor have to work in spite of suffering. Any pain, may it be due to organic disease or to a functional disturbance of the system, is felt less acutely when the mind is occupied with some other subject, but as soon as the interest ceases, the pain is felt at once and usually more severely. The rich and well to do keep up, the poor are complete wrecks when they should be in the prime of their lives,

and so we are often surprised and shocked to find an old acquaintance, after a few years of marriage, completely broken down, when we knew her but a few years previously, as a rosy girl in perfect health. To be poor is a disadvantage in any disease. Just so as we find this class of patients working in spite of their troubles, we find an untold number affected with serious diseases of lungs, heart, kidneys and liver forced to work to sustain life. Even under these disadvantages we can do much to alleviate pain and prolong life.

It is especially this class of patients with relaxed abdominal walls, pendulous bellies, displaced abdominal organs, that need rest in the recumbent position. These patients usually look anemic when an examination of the blood shows a normal hemoglobin and normal number of red and white cells. The apparent anemia is due to a faulty distribution of the blood. These patients have the blood in their abdomen instead of having it well distributed throughout the body. The cold hands and feet are due to this fact and their nervous chills are caused by it. We find the superficial arteries contracted, often giving one the impression of a well developed sclerosis in the young, and if the condition is not relieved, it gives rise to permanent premature sclerosis. We see this daily in clinic and office.

The contraction of the arteries is a defensive measure of Nature to accommodate itself to the deficient blood volume in the periphery and to raise the pressure to supply the demand. Notwithstanding we find often low pressure, more frequently the pressure rises above the normal and goes hand in hand with a rapid and small pulse. The whole circulation is seriously disturbed and the arterial walls are excessively taxed and aggravated, not rarely by a movable heart.

The pseudoangina, which are observed in these cases are due to this condition. Rest in the reclining position changes the heart's activity. The abdominal viscera sink back in position or right themselves, gravity ceases to act injuriously, and the blood flows readily into the head and upper portions of the body, putting off old age in fact and in appearance. I have found it rarely necessary to adopt the prolonged rest treatment, and in the vast majority of cases on account of financial reasons it is impossible.

The intermittant rest is usually sufficient. This should be coupled with proper exercise, diet and other methods of treatment as they may be indicated in each case.

Most of these patients are accustomed to sleep without a pillow, feeling the want of blood in the head, which impels them to raise the foot end of the bed, improving the general circulation, emptying the congested abdominal organs and allowing the blood to flow into the upper portion of the body. The morning headache as a rule disappears and it is a valuable help in the treatment of diseases of the head and chest.

Some of these patients sleep on the stomach, allowing the kidneys to float back to the normal place and remove pressure from the spine.

Only in extreme cases and not before trying this method have I used the prolonged rest with seclusion, massage and electricity.

The method of intermittant rest is less expensive, less burdensome and allows the patient to take the amount of exercise which is necessary to keep the circulation in good condition and to make muscle.

If prolonged rest has to be adopted, seclusion is necessary to be successful and for this purpose the patient is best treated away from home, relatives and friends, not seeing anybody but physician and nurse, who can give massage and electricity. The treatment can be combined with the open air treatment and the sun bath, as stated before, which assures greater divergence. It should always be born in mind that complete rest to mind and body is the object of the treatment.

Frequently we are forced to treat these patients in their homes. In these cases it is best to change the room and select one connected with a gallery. There can be no hope of success unless the orders are strictly carried out and it is better not to commence the treatment at all if the patient and relatives are not willing to strictly obey instructions.

It is merely necessary to mention that a large number of the organic diseases of the nervous system can be benefited by rest treatment.

Weir Mitchel reports a number of cases of *tabes dorsalis*, which he has treated with his method, and obtained good results.

Rest alone will do much to diminish pain and promote sleep. In advanced cases he advises a long period of rest in bed, readily accepted by the patient, who suffers from incoordination, pains, and numbness of the extremities, which often incapacitate him. If the disease is easily recognized, partial rest,

intermittent rest, is sufficient. Massage is gradually followed by passive and active exercise.

I agree with Hilton that rest is a boon to humanity and that it should be used to the full extent of its therapeutic value.

We are greatly indebted to Weir Mitchel, who first used it in combination with massage, electricity and diet, and demonstrated the value of this method in the treatment of the sick.

CHAPTER V

Massage and Exercise

MASSAGE

Massage is a part of mechanical therapy, especially adapted to move the liquids of the body at will, from place to place, and from organ to organ; it increases metabolism, inhalation of oxygen and exhalation of carbondioxide, assists in the removal of toxic substances and causes absorption and elimination of liquids and solids in abnormal conditions. The organs and the skeletal muscles gain in volume and strength, and the whole system in health and resisting power, by the proper use of this method.

The direct effect of massage is an active hyperemia. It can be used with advantage in almost every disease, contra-indications are few.

A warm and soft hand and a gentle, but firm, touch are necessary for its successful use. It must be employed with a definite purpose, to assist the functioning of the organs and tissues of the body by its application to stimulate or to slow. It empties veins and lymphatics and drives the liquids from periphery to center towards the heart. The arterial blood follows the advancing stream and as the capillaries are emptied as well as the larger vessels, the parts of the body treated, are supplied with fresh blood. The powerful influence upon blood and lymph circulation has a decided effect upon the heart; its work is eased by general massage and massage of larger portions of the body. Capillaries widen and skin and mucus membranes turn red, due to a hyperemia, caused by paralysis of the vasomotors.

The effect of massage is greater in disease than health, pathological conditions are readily influenced and local congestions due to tumors, scars, etc., rapidly improved. However, when venous thrombosis or a chronic inflammatory process prevents the passage of blood, the greatest caution must be used and massage should never be given over such a focus. The effect upon the lymph circulation is still more decided and even of greater importance, as usually the flow is slight and with massage large quantities of lymph are moved, proven experimentally by a number of investigators. The lymphatic system has been aptly

called the drainage system of the body, and we understand its importance, seeing that with massage we can rapidly free diseased portions of the body from waste and toxins, by way of the lymphatics.

Transudations and exudations can be brought to absorption, though caution has to be used not to throw too much liquid at any one time into the blood and lymph stream, which would overburden heart and kidneys, especially when these organs are diseased. Not alone abnormal collections of liquids, but solids as well, such as infiltrations and even bony excrescences can be diminished or entirely removed by massage.

Muscles and organs influenced through the improvement of blood and lymph circulation, increased metabolism and removal of waste and toxins, and directly by the manipulation causing muscular contractions, exercise to the muscle, result in gain of volume and strength. A short, decisive, even light blow across the fibers of the biceps or any other large muscle, cause a contraction, shown by the function of that muscle, for instance, bending of the arm and by a knot that slowly appears and disappears upon the muscle after the blow. Tapotement may be compared with the Faradic current, causing innumerable muscular contractions, following one after another in rapid succession. The reaction, that is contraction following the blow, is immediate in a healthy and strong muscle, slow and slight when the muscle is weakened, and in a degenerated muscle no reaction takes place. In nervous people, even weakened muscles react usually with precision and force. Massage of the muscles removes the sensation of fatigue, probably due to the removal of fatigue toxins.

The effect of massage upon the nervous system is the same as that upon muscles and organs; an improved circulation causes improved metabolism and improved functioning. It is of importance that highly sensitive and painful parts cannot alone be treated, but that massage skillfully applied will soothe and stop pain altogether. The application, very gentle at first is gradually increased in strength, as the sensations of pain lessen.

Blood pressure changes according to method and strength employed. The soft and gentle stroke decreases and tapotement increases it. This is especially marked in abdominal massage. The influence upon temperature is unimportant, usually a slight increase of the body temperature and a larger rise of the temperature of the skin is noticed. Secretions and excretions are changed, the output of solids in the urine is increased and large



Figure 1

quantities are voided during the time of absorption of transudations and exudations, under the influences of massage. The improvement of bladder and intestinal symptoms is sometimes remarkable and cures may be effected when every other method has failed.

In atheromatous and calcarious degeneration, on account of the liability of rupture of vessels, in scurvy hemophilia, aneurysm, leukaemia and similar conditions, massage is contra-indicated. Edemas when due to heart and kidney disease must be treated with skill and caution. If too large an amount of the edematous fluid is thrown into the circulation, heart failure or a uremic attack may be the consequence.

In cholelithiasis and cyst formations massage must not be given over the diseased area. It might cause rupture. Tubercular, syphilitic, acute infectious inflammations and malignant tumors should never be treated by massage. The method spreads the virus and pyamia, miliary tuberculosis and malignant metastosis may follow. It is an important general rule never to throw anything into the general circulation that might cause damage.

The principal manipulations of massage are few and simple, but may be varied as occasion demands it. Stroking (effleurage) rubbing (friction) kneading (petrissage) beating (tapotement) and vibration (vibration) to which may be added pulling, stretching and bending, are the chief means adopted. If massage causes pain, it is not well given and if the patient feels exhausted after the treatment, the time of application should be shortened. The nails of the operator have to be kept short—he should not wear rings, and his hands should be thoroughly cleansed before and after massage, which should not be given shortly after meals. An hour between meals is best suited. Though all this is self understood, I have seen it so frequently disregarded, that I thought it best to mention it. The patient should lie on a hard mattress, covered with a light blanket, or he may be kept in bed, if for some reason this is more desirable. Every muscle of the body must be relaxed and the masseur himself has to be in a comfortable position, to give the treatment well. He has to observe his patient and notice the impressions the treatment makes upon him, be gentle or firm according to the purpose he has in view, and the sensation of the patient, as he notes them in his face. It is especially of importance to avoid pain and exhaustion. The operator has to feel his way and use tact and judgment.

Every treatment is best commenced with effleurage and if massage to the whole body is indicated it is best to commence with the feet, legs and thighs, in succession. The stroke follows venous and lymph stream from periphery to center and as these fluids are moved onward, visible in the larger veins, arterial blood follows. At the same time the tissues are drained and the liquid is passed into the veins. Effleurage empties superficial veins and lymphatics and acts soothingly upon the peripheral nerves. No matter how sensitive and painful the parts may be when treatment is commenced, a gentle massage soothes and frequently stops pain altogether. (Figure 1).

The hand is placed lightly upon the portion of the body to be treated and moulds itself to the surface and the fingers are closed. If this is not observed it irritates the patient, especially when a sensitive part is treated. After the stroke, made with gentle pressure, from periphery to center, the hand is allowed to glide backward without being raised from the surface, to avoid irritation, and a to-and-fro movement is kept up. The pressure, especially with the palm of the hand is gradually increased as it becomes desirable to affect parts below the surface and to influence and to move deeply seated pain. The movements must be soft and elastic and the joints of the operating arm and fingers kept loose. Sometimes the finger tips may be used in combination with the hand to reach structures beneath the surface; their soft volar portions are pressed deeper and deeper with each upward movement, and the pressure removed on gliding back to the place of commencement. Elasticity and gentleness of this proceeding is even more important, than when the massage is given with the palm of the hand alone. It is apt to cause pain and irritation, if these movements are not gentle and elastic. Deeply seated tendons, muscles and nerves may be reached in this way. As we proceed, the hand gradually forms an angle, which becomes steeper and steeper as the deeper structures, and even the bones, are reached. If greater force is needed, the hand, lightly closed in the form of a fist, may be used. The pressure must be made with the soft portion of the fist either in a vertical or horizontal position, and the knuckles of the fingers, though kept in contact with the surface, should not be allowed to press; they will cause pain, especially to be avoided in giving massage.

In a large number of cases massage may be given without a lubricant, and this is usually preferable to increase friction. In others, too much friction is irritating and painful, and a lubricant,



Figure 2

such as olive oil, lanoline softened with olive or sweet almond oil, white vaseline, etc., may be used to lessen friction. The application of oil causes the growth of hair and should not be used in places where this is not desirable.

Furuncles and boils are easily avoided by strict attention to cleanliness.

Effleurage may be used to cause absorption of medicaments—mercury in syphilis, iodoform or eucodene in tuberculosis, quinine in malaria, etc., and fats, especially animal fats, such as lanoline or goosegrease and cod-liver oil in cases of waste, in tuberculosis, cancer, serious gastro-intestinal troubles, chronic infectious diseases, etc. For this purpose the inner surfaces of arms and legs, the abdomen and back are best suited, being mostly free from hair and more tender, and having less epithelial covering.

This method of medication is of great advantage as it does not upset the stomach, and presses the medicaments and fats directly into the lymphatics, a matter of importance in syphilis, which continues to spread along the lymph channels containing the virus, when all other portions of the system are long free. It is in these diseases that inunctions have proven of the greatest value. This explains the almost unanimously acknowledged fact that mercury by inunction gives the best results in the treatment of syphilis, far superior to the other methods in use.

In the treatment of diseases of childhood this method is of special benefit and often the only one that can be used with advantage. (Figure 2).

Effleurage should be followed by petrissage the kneading of the portions of the body treated. This acts upon the deeper portions and affects muscles, bones and deeply situated vessels and nerves. The kneading following the stroke from periphery to center empties the deeply seated veins and lymph vessels, moves fluids and the flow of arterial blood in the deeper arteries follows.

The hand, with fingers closed, is placed upon the portion of the body to be treated, and opened and closed in rhythmic contractions, grasping muscles or groups of muscles with the hollow of the hand. The contractions imitate the heart's action, a longer systole and a shorter diastole, pushing forward, emptying the vessels and moving the fluids towards the center. The pressure is made with the ball of the thumb and the palm of the hand and though firm has to be soft and elastic to avoid pain. It may be

made rapid or slow and modified to suit the purpose, but it is important to allow the hand to glide backward to the point of commencement without raising it from the surface. If this is not done, every new touch irritates, whereas the continuous motion soothes. The hand, acting as an artificial heart, milks muscles and tissues of their fluid contents by contraction and relaxation. Instead the part to be treated may be grasped between the tips of thumb and forefinger, or all the finger tips may be used in this manner. Skin and fasciae, muscles, nerves and vessels, and even the bone, may be treated and single muscles may be selected, if desired. The tips of thumb and fingers grasp the muscle or muscles, and opening and closing, and pushing onward, raise it slightly from the underlying parts, and allow it immediately to return to the proper position on opening. In this way the muscle is thoroughly kneaded and its contents of blood and lymph pressed onward. Both hands may be placed upon the surface, one opposite the other, enclosing the part to be treated, the one pressing upward, whereas the other is moved in the opposite direction. The manipulation is used in connection with kneading. (Figure 3).

A useful method of kneading is the "Kammgriff" of the German. Both hands are closed and placed in horizontal position upon the surface, the thumb of the right hand passed into the hollow of the left fist, the whole imitating, as it were, a comb. Both wrists are then simultaneously bent lightly upward and downward and the artificial comb pressed forward, emptying the vessels to any desired depth. Under this treatment, which when properly given, is very agreeable to the patient, the surface reddens rapidly and soreness and pain disappear. Only large areas of muscles can be treated with this method. For instance the muscles of the back, gluteals, thighs and calves of the legs, etc. The hands must, as in the other forms of massage, glide backward and must not be raised from the surface, and the movement must be gentle, firm and elastic.

The beating "tapotement" is used to cause muscular contractions and follows petrissage. The blows must be light and elastic and must be delivered in rapid succession. Only portions of the body that are well covered by fat and muscle can be thus treated. Various methods are in use and all may be employed now and then with advantage. The masseur may select either, as indicated; of greatest importance is the elasticity of the blow, light yet strong. If this is not strictly observed the blows



Figure 3

will be painful. Nervous patients, neurasthenics and hysterics are rarely suited for the treatment of tapotement. (Figure 4).

The blows may be delivered with the ball of the little finger, the hand in the vertical position and formed to a fist. The blows are usually given in rapid succession and on striking the surface are immediately reflected upward. In another but equally effective method the fingers are spread fanlike and as soon as the border of the little finger hits the surface, the wrist is lightly turned and allows finger after finger to strike the surface. Both hands may be used at the same time, the one coming down after the other. The wrist movements are outward and the beating is done in rhythmic succession—a procedure more agreeable to the patient. This method allows innumerable blows to be given in very short time and the effect resembles that of the Faradic current. (Figure 5).

If a small area is treated the finger tips may be used coming down in rapid succession and returning with the greatest possible elasticity.

Elasticity and lightness of the blow are the first and most important conditions in tapotement, to avoid pain. If it is correctly given even strong blows will not hurt and blue spots will not follow the treatment.

Slapping with the palm of the hand, more or less hollow, so that sometime the whole and again only the border of the hand strikes the surface, may be done occasionally. This manipulation gives loud sounds and may be employed on that account for suggestive purposes.

Rubbing (friction) is used to soften and loosen infiltrations and prepare them for absorption with the other methods of massage. The finger tips or the palm of the hand may be used for the purpose and the rubbing is done with a forward and backward or a circular motion, with more or less force, as may be indicated. It is always best to commence very gently and gradually to increase the pressure and friction and an intermittent downward pressure often assists very much in loosening up old infiltrations.

This, as well as all the other methods, may be varied to suit the purpose and the operator.

Vibration is especially suited for the treatment of neuralgias, though even when a general massage is given it is of advantage to administer it over the large nerves such as the solar plexus, sciatic nerve, supraorbital, trifacial spinal roots, etc., following petrissage and friction. The hand is gently placed upon the sur-

face with the finger tips over the nerves, then gently raised under an angle to the surface, more or less vertically or the tips of the fingers may be united over one small circulatory area of a nerve or nerve plexus and vibratory motions, a tremor is then produced.

The manipulation is fatiguing to the operator if he has to give it often, and may be replaced by the one of the many vibrators now in the market.

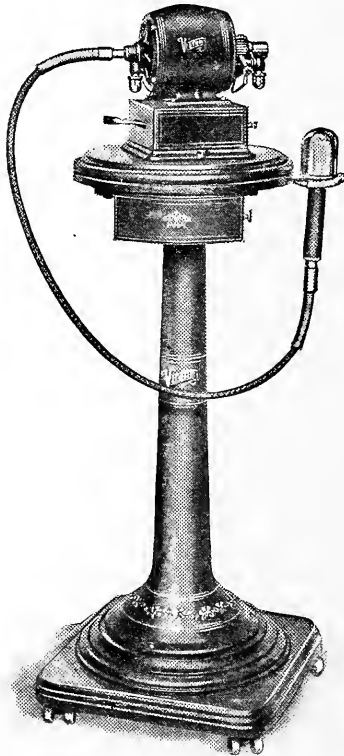


Figure 6

The effect upon the nerves is mechanical excitation, and upon the vasomotors, excitation followed by paralysis, influencing the circulation. It is of special use to influence the voluntary muscles. Stretching and pulling may be added to these manipulations of massage. Nerves, muscles and tendons may be stretched by gently bending or directly pulling the joints. Caution, gentleness and firmness are rules to be observed, no matter what form of



Figure 4

massage is used. This method is often employed and is of great value in the diseases of the spine, in sciatica and in joint affections.

A general massage is commenced with a gentle stroke, gradually increased in strength and firmness, followed by rubbing, kneading and beating if indicated, then by vibration and the procedure closed with effleurage. This line of working may be adopted as a routine measure and is of advantage in most cases, though it may be changed to suit the purpose. One or the other of manipulations may be left out altogether and others added, designed by the operator. The purpose for which massage is given must never be lost sight of.

In cases of diseased joints or injuries to muscles, etc., it is best to treat the part by commencing with the stroke above the focus so that lymph and blood are drawn from the injured joint or bruised muscle, and follow with massage over the focus itself.

Massage should not cause pain and should never leave blue spots. If it does, it is a sign that it has not been given with skill. It must soothe and stop pain and though it may leave in the beginning a slight sensation or soreness resembling that caused by riding or walking after a long time of rest, it is never disagreeably felt when skillfully given. The best time to give it is in the morning after a light breakfast or two hours after a meal; it should never be given after a full meal and the time of duration must be left to the judgment of the masseur. From five to ten minutes over a focus and from twenty minutes to half an hour, if the whole body is treated, is the rule. The massage in the beginning is best given daily. Once a day is usually sufficient, though in some cases of injury it may be employed two or three times daily. As improvement follows, the application may be administered every other day, and so on. The feeling of the patient has to be considered as well—if too tired the time has to be shortened.

EXERCISE

Exercise is divided into active and passive exercise, and like massage is well adapted to move the fluids of the body at will to any part needed. In active exercise the patient executes the movements himself, whereas in passive exercise they are given by the operator or by a mechanical apparatus, designed for this purpose.

Exercise may be given with and without resistance. If the latter form is employed, the physician resists the movements of the patient and grades his resistance to the strength of the patient, or the patient resists the movements of the physician.

Nerves, muscles and joints, as well as all organs, are influenced by exercise. It causes a hyperemia; muscles fill with blood and lymph and grow while atrophy follows their disuse. This is an observation that can be daily made. An athlete to prepare for an exhibition, trains, and his muscles grow in bulk and strength. A broken arm or leg enclosed in a plaster of Paris bandage is found to have wasted after the removal of the bandage.

Exercise draws the blood from center to periphery, chilly sensations disappear, cold hands and feet grow warm. The face becomes flushed and the body covered with perspiration when exercise is carried on to excess. Muscles and fascias are stretched and shortened by its influencing blood and lymph distribution in the muscles; and lymph flows rapidly through the ductus thoracicus, when the extremities are rhythmically moved. In the daily occupations of modern life only certain joints and muscles are used and those not used waste. Joints commence to crack after middle age, due to malnutrition, causing changes in cartilage and capsules. Exercise prevents this effectually and corrects it when established. Nerves are stretched, their reflex excitability reduced, and metabolism improved, of importance in the treatment of neuralgia and neuritis. A number of observers report success with this therapeutic measure in spinal diseases. Arterial pressure rises during exercise and is compensated by decreasing tone in vessel walls and widening of the arteries. A greater quantity of oxygen is inhaled and carbondioxide exhaled. Fat is burnt up and water is lost.

Exercise is the most valuable method to reduce the obese. We can use it to treat the whole body or one joint, one muscle or one group of muscles and a diseased joint or wasted muscle may be brought by methodical and appropriate exercise to perfect functioning. It is the blood brought to the diseased parts that cures. Exercise influences blood distribution in the organs. It acts afferent and efferent, veins are emptied and arterial blood follows. If we contract the muscles of the arms, the blood is pressed into the chest and if we raise them we obtain the same result by gravity. Swinging of the legs without muscular contraction draws blood into them by centrifugal force and raising

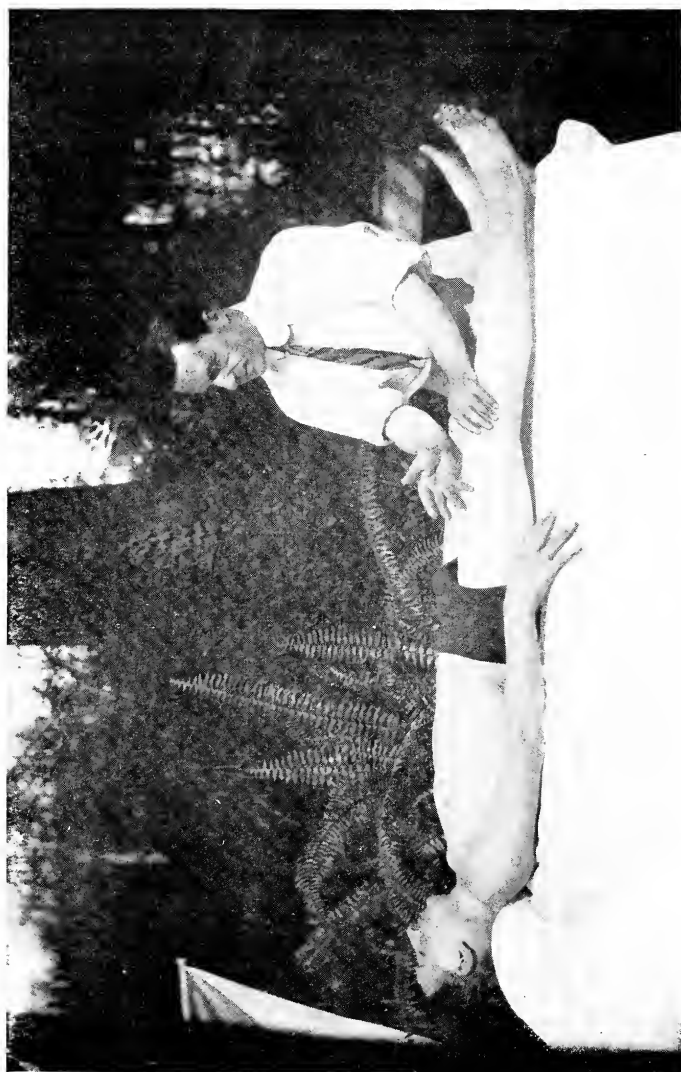


Figure 5

of the legs when in the reclining position acts efferent upon the extremities and afferent to the abdominal organs by gravity. Exercise is a method of treatment especially useful. It influences the blood and lymph stream at will; it burns up fat and waste matter and removes toxic substances from the blood. It is inexpensive and therefore can be employed freely in the treatment of the poor, and it is of great value in all chronic diseases of the lungs, chest and abdominal organs, in convalescence after the acute infectious diseases, in surgical and gynecological affections and invaluable in orthopedic surgery. As a prophylactic measure to preserve health it can not be surpassed and though it is somewhat tedious, the habit is quickly established, lightening the labor, and its combination with the air bath makes it refreshing and less burdensome. To the room gymnastics the usual physiologic exercise, walking, horseback riding, rowing, golf, tennis, etc., are added when indicated. Contra-indications to exercise are but few. Passive exercise can be given, of course, with due caution, even in heart disease with a completely broken compensation. If carelessly or excessively used, it will do great harm. In acute infectious diseases, in advanced arterio sclerosis, etc., active exercise must not be prescribed. If correctly given it acts as a curative and if abused, it fills the blood with waste and breaks down organs and the whole system. It has to be carefully selected and prescribed with caution.

The young need exercise to develop muscles, bones and organs. The whole body needs it—the aged to prevent rapid decay and the sick to re-establish a disturbed circulation and to purify rapidly the blood. In fact it is impossible for anybody to regain health when it is lost and to preserve it without exercise. Rest and exercise are Nature's means to cure and to preserve health.

THE TECHNIQUE

Various starting positions have been designed from which to proceed. Standing like a soldier at attention is the first and the most frequently used position. The head is carried high, the chin tilted down, the eyes are looking forward, the shoulders are drawn back and the chest is well expanded. The arms are hanging down, slightly bent at the elbow, the hands, fingers closed, touch the outside of the thighs. The abdomen is drawn back, legs are stretched and knees pressed through. The heels touch

each other and the feet are rotated outward at an angle between 60° and 90°.

In the sitting posture the upper portion of the body is kept in the same position as above. The hips, knees and ankle joints are bent to a right angle and the arms hang down of their own weight, as in the standing posture. The patient sits on a chair, the feet resting on the floor. In the recumbent position the whole body of the patient rests on his back upon a hard mattress or carpet. The legs are stretched and kept close together, the arms close to the body, rest on the support. In the hanging position, the patient hangs on rings, on a bar or trapeze. The hands grasp the bar in overgrasp hanging position and are at a distance equal to the width of the body, the arms and legs are stretched and the feet do not touch the ground.

The disease to be treated and the object in view will indicate which position is to be selected to start with. Weakness of the patient after an exhausting infectious disease, heart disease with a broken compensation, breathing exercises and those that influence intestinal peristalsis require usually the recumbent posture. In some diseases of the heart and in emphysema of the lungs, the sitting posture is indicated and diseases of the spine are usually treated in the hanging position.

Innumerable exercises have been developed by the Swedish school from these and more complicated starting positions, alone, and in combination.

The weaker the patient the more simple the exercises to be designed, and their number has to be few at the start and gradually increased, as improvement advances. A few simple movements may be given to move every joint and every muscle in every possible direction in the beginning.

Standing at attention, the hands resting on the hips forward, the fingers are closed and the thumb under a right angle turned backward "wing position".

MOVEMENTS OF HEAD AND NECK

The head is gradually turned sideward, forward, backward, bent sideward and finally turned in a circle to right and left. These exercises move every joint of the upper portion of the spine and every muscle of the neck. Movements of neck and head are used to relieve rheumatic pains and headaches, stiffness or weakness of neck, torticollis, etc.

Every joint of the spine is moved, the muscles of chest and belly, the muscles of the back, arms and legs all are used to their fullest extent as well as the hip joints. Respiration is especially influenced and inhalation and exhalation must be carefully suited to the movements.

Bending backward restrains the respiration and should not be carried on too far and this position should not be kept too long for the same reason. The circulation is improved, digestion favorably influenced and constipation relieved. It is a compression, a massage of the abdominal organs.

Bending forward stretches the spine and sciatic nerves and strengthens muscles of back and belly. The same movements executed in the sitting posture act stronger upon the muscles and organs, less so upon those of the back. The abdominal contents are pressed between the thighs and trunk when the patient is bending forward in the sitting posture.

Bending backward and sideward and turning the body in a circle all may be executed in this position. The movements in the recumbent position have to be combined with those of the legs.

Starting position: The patient lies on the floor upon a carpet or hard mattress, legs are stretched and kept close together, and the stretched arms touch the body, the palm of the hands resting on the thighs. The legs are next drawn up so that the thighs press upon the abdomen and the legs held parallel to the trunk. They are then stretched with force to return to the starting position. Or the patient lies flat on his back with arms sideward stretched. The legs as in the starting position, are next thrown one over the other, or the trunk is turned from side to side, the legs raised under an angle, with arms left in the original position. One of the most useful exercises in this position is raising the trunk from the starting position into the upright posture, or the legs close together are slowly swung upward and forward over the trunk, and head raising its lower portion from the floor.

All these various movements affect the abdominal muscles and the contents of the abdominal cavity. They are especially indicated in constipation, but are also useful to stretch the spine, the sciatic nerve and affect the respiration. With it, they act afferent upon the abdominal circulation and improve the composition of the blood by increasing metabolism and removing waste.

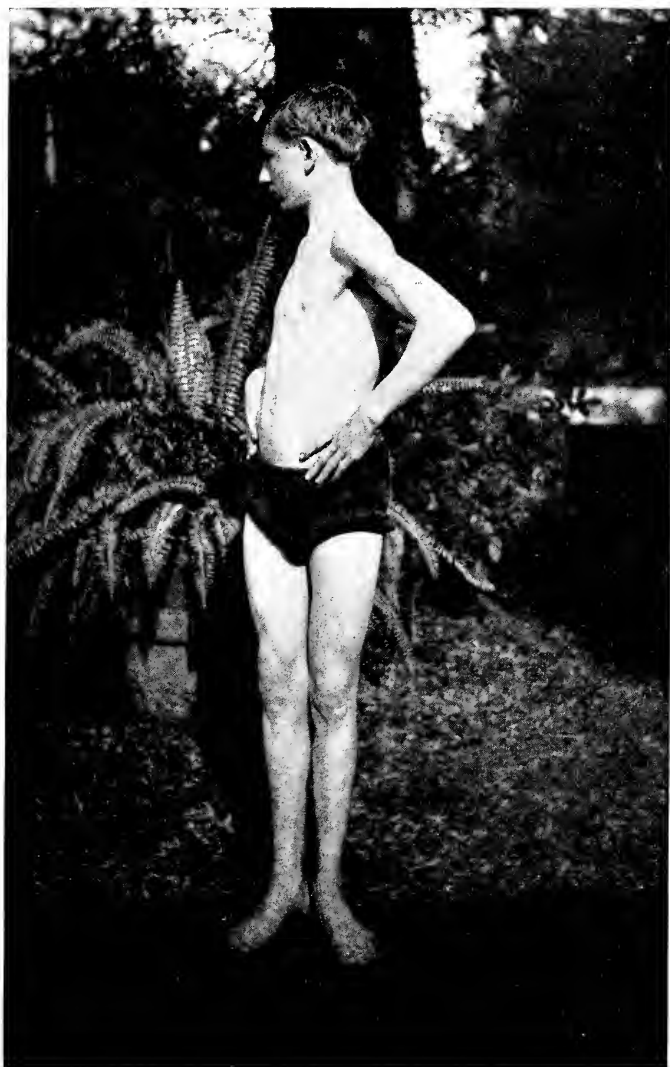


Figure 8

THE MOVEMENT OF THE LEGS

The patient stands in the wing position, and bends first one, and then the other knee to a right angle, next the legs, one after another are stretched forward, backward, and sideward, then outward and inward, rotated in the hip joints, the knees bent under a right angle; then they are swung forward like a pendulum, backward and sideward and rotated in the hip joints, with legs stretched. The feet are next moved in the ankle joint, upward, downward and sideward raising the border of the foot, rotation in the joint follows, inward and outward, and lastly the toes are moved. These exercises move every joint of the lower extremities, hip-joint, knee-joint, ankle-joint and toe-joint, with their muscles and nerve supply attached, many others may be added. (Figure 9).

From the first starting position, with arms in wing position, the patient may go into the knee-bent position, with heels raised, standing on his toes and gradually stooping and rising in this posture, the knees close together when pressure on the abdominal walls is desired and spread under an angle if this is not wanted—or he may be directed to pick something from the ground, left leg stretched, right knee bent and trunk leaning forward and changing, right leg stretched, left knee bent and trunk being forward, jumping forward and backward—the position of the professional fighter. Forward lunge, standing sideward, stepping forward, backward and sideward, etc., all may be used when indicated. Several of these exercises may be combined and various forms of apparatus may be used to increase their efficacy. (Figure 10).

A wand, length about four feet, should be used for an adult when commencing the exercises. The wand is best made of wood; later as the patient grows in strength, an iron wand may be used instead, and dumb-bells and Indian clubs may be added, with the various simple or combined movements described. The wand is grasped with both hands or with one hand, raised above the head, put on the floor and picked up, raised and put behind the shoulders, raised again, and so on. Dumb-bells and Indian clubs may be used for swinging, and to enforce the movements with arms and hands. The lunge positions are useful for dumb-bell exercises and may be further used in any combinations desired.

EXERCISES ON THE TRAPEZE, BAR OR RINGS

The hanging position, simple hanging, hands in undergrasp position, at a distance of the width of the body from each other, legs close together, toes pointing downward. Raising in this position to elbows bent. Grasping the rings in overgrasp position with toes on the ground and swinging in a circle. The patient hanging on a bar in starting position lifts the legs parallel to the ground under a right angle to the trunk, or lifts the whole body, legs stretched, and many more. These exercises are useful in the treatment of scoliosis.

EXERCISE WITH RESISTANCE OF THE OPERATOR

All the exercises described may be executed in this manner, the physician resisting the movements of the head, the extremities and of the trunk. A special advantage of this mode of giving exercise is that single muscles can be treated, the resistance suited carefully to the strength of the muscle. It is a method that needs the greatest care and should be used only by the physician himself or a well trained masseur. The indications are the same as for all other exercises, to strengthen muscles, return normal movements to stiffened joints, and to stretch nerves, tendons, fasciae and skin. The treatment influences the circulation and improves the blood.

The exercises with the Zander apparatus are especially suited for passive exercises and exercises with resistance. On account of their expense they can be only used in a well equipped institution and the general practitioner has to dispense with them.

To derive the *greatest benefit from exercise it must be automatically performed*. The higher centers must have nothing or little to do with its execution, as they soon tire and the patient will feel fatigued and exhausted after the slightest exertion. It is of importance when directing exercise to take this factor into consideration and select accustomed exercise, coupling it with an interesting occupation. Walking to the market for the housewife, and to his office for the husband—horseback riding, golf, tennis and other active games that permit exercise to be automatically performed.

If indoor exercises have to be adopted, the patient's attention has to be called to the fact that they will be tiring till they are learned, that his brain, not his muscles tire and that his task does not amount to as much as his accustomed daily walk—that



Figure 9

he will be able to use them with the same comfort and ease as soon as he is able to do them without thought, or with pleasant thoughts of business or pleasure.

It is necessary to begin these exercises slowly and gradually and to observe and encourage the patient, until he has thoroughly mastered them.

I have often had patients come to my office, tell me that they had to give up the exercises, as they were too exhausting and fatiguing. It is this statement that has led me to the explanation, and ever since I have had no trouble.

Exercise is best given between meals, not with a full stomach and not with a stomach entirely empty. Moderate exercise given before bedtime induces sleep in many, and it prevents others from sleeping. This has to be considered in prescribing it. These exercises are best combined with the air bath and executed in the open, on a gallery, protected from curious eyes, or in a room with doors and windows wide open, as mentioned before. If clothing is worn, it must be loose and not hinder the movements. Diseases of the vessels, fever, the infectious diseases, tendency to hemorrhages, etc., contra-indicate exercise. In some of these conditions special moderate exercise is useful.

MASSAGE AND EXERCISE IN DISEASE

GENERAL MASSAGE

General massage is indicated in convalescence from the acute infectious diseases and in chronic affections, almost without exception. In the acute infectious diseases due to the disease itself and to the treatment with rest in bed, the functions of every organ are seriously disturbed, and toxic substances deposited. Massage directly influences the movements of blood and lymph, and eliminates toxic matter. In consequence, it is the cause of improved functioning of lungs and heart, of liver, kidneys, intestines and of every other organ. Muscular and nerve strength follow. Even the healthy feel better after a massage and the sick improve under the treatment in appearance, weight and strength, and a sensation of health, in returning appetite and sleep. The feeble and nervous, and the hysterics and neurasthenics are especially well suited for this treatment, and are often entirely cured by this method, coupled with rest and over-feeding. Weir Mitchel is the originator of this treatment: Systematic use of rest, massage, electricity and feeding for these patients, and he and many others who have employed it have reported success

when every other method of treatment had failed. Gout is another disease that is thoroughly influenced by it. Metabolism is improved, the output of nitrogen increased, deposits and infiltrations brought into the circulation are eliminated or burnt up, stiffness of joints removed and muscles strengthened. Massage should not be given to these patients till the acute attack has passed, only a soft and gentle stroke above and over the inflamed joint may be tried to soothe after the severe pain has decreased. Passive and active exercise, such as walking, horseback riding, golf and other pleasurable exercises have to be added to the treatment.

In diabetes, general massage is of great value to get rid of the waste matter, and to eliminate and burn up toxins, sugar, etc., contained in the blood. Dosage as in any other disease is of importance and a proper dose can only be fixed by experiment, commencing very cautiously and gently, observing improvement or contra-indications and stopping short when the method is injurious. Diabetics are subject to skin affections, and these are dangerous to these patients and must be avoided by scrupulously adhering to cleanliness.

In all forms of chronic intoxication or autointoxication, mercury or lead poisoning, etc., general massage is a supreme remedy. It cannot be too often mentioned that one method alone is hardly ever effective and has to be combined in every case with others to get the best results. The object to be obtained, a pure blood and a perfect circulation is fundamental. It is impossible to discuss here every condition and disease in which general massage is indicated. Every physician who understands the method and its action and can make a diagnosis will readily know when and how to employ it. As a general plan to give it, the following outline may serve:

The patient is placed upon a mattress, not too soft, covered with a light blanket, or he lies in bed between blankets. The massage is commenced with effleurage of feet, legs, and thighs, petrissage, friction and tapotement follow and the procedure is closed with effleurage.

He lies first on his back and when feet, legs and thighs are finished he turns completely to receive the same treatment upon this portion of the lower extremities. In a similar way the upper extremities are treated. The back follows—effleurage from the spine outward and upward, center, outward—and over the lumbar region, outward and downward. Petrissage and rubbing are

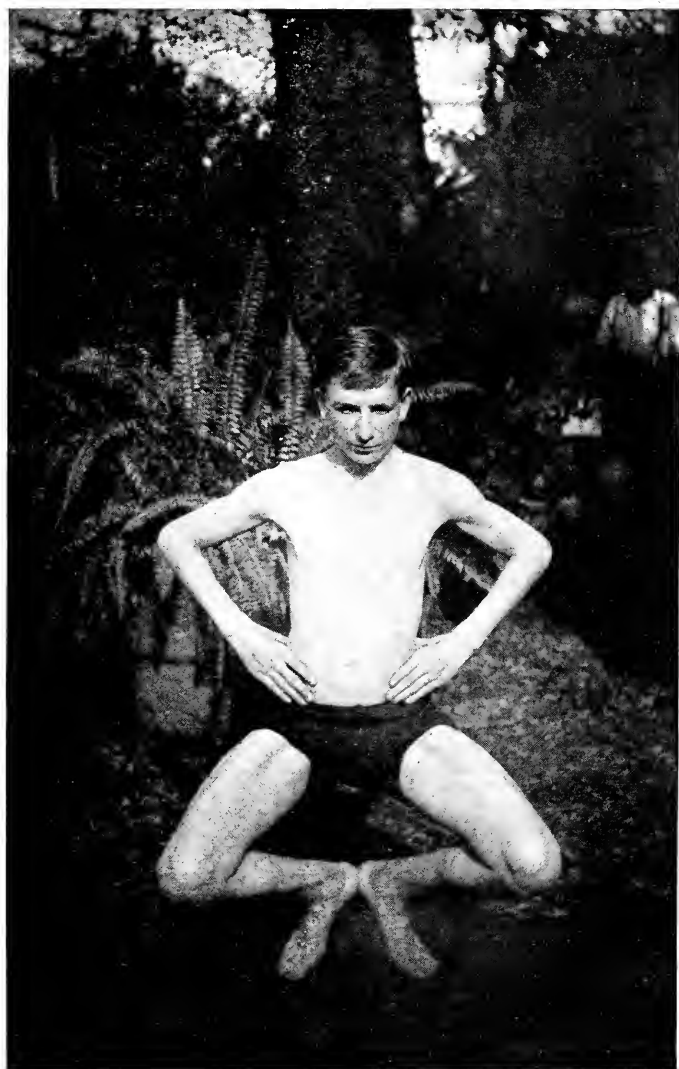


Figure 10

thoroughly done, first both sides along the spine, upward and downward and a strong stroke upward or downward over the spinal processes. A thorough kneading outward and upward on both sides and away from the spine, outward and downward in the lumbar region. Then follows tapotement and finally vibration along the spine, especially over painful points. This slows pulse frequency and has been called the *digitalis* of the masseur. The massage is closed with effleurage. The treatment of the back of legs and thighs may follow or precede the massage of the back. The abdomen is then gently treated with circular strokes around the navel from right to left and the chest from the sternum outward along the intercostal spaces. In some cases rubbing may be added.

After the massage is finished, passive exercises are usually added. The joints are moved in every possible direction and pulling and stretching follow as indicated. During massage every muscle must be completely relaxed and the position always so selected as to accomplish this most thoroughly.

MASSAGE OF THE NECK

The patient sits on a chair. This increases the velocity of the cerebral circulation. The stroke follows the blood and venous stream coming from the head along the large vessels of the neck. The muscles are kneaded. The masseur sits in front of the patient, places his hands so that the hands with closed fingers encircle the back of the neck, the thumbs in front of the ears and their balls resting at the angle of the jaws. The stroke is made downward over the large veins, with gentle pressure and continued over the shoulders towards the joints, the thumbs pressing below the clavicles, moving outward. The kneading of the muscles follows in the same direction and tapotement may be added. The masseur stands next behind the patient, thumbs stretched behind the ear and the hands encircle the neck in front. The hands glide downward to the shoulder then outward to the joints and the stroke is gradually increased in strength, kneading of the muscles follows, with tapotement. Passive and active movements of the head, with and without resistance, are useful in torticollis, rheumatic affections, etc.

In hysteric aphonia and chronic laryngitis, massage of the throat gives good results. The throat is treated with effleurage, followed by vibration, best applied with a vibrator, though the

Adam's Apple may be grasped between thumb and fingers and vibratory movements thus performed. Inflammatory conditions of throat and tonsils are treated with effleurage of the neck.

Massage of scars caused by burns or surgical operations should be done by stroking, rubbing, kneading and stretching the affected parts. The mucous membranes of throat, nose, mouth and gums are treated advantageously by this method, especially in various inflammatory conditions. Sounds and specially designed instruments, with or without cotton wrapping, and with or without medicaments, are used. In diphtheria, tuberculosis, malignancy in syphilis, Basedow and similar diseases, massage is contra-indicated—it spreads the virus.

MASSAGE OF THE HEAD

This is generally preceded by massage of the neck, which influences the cerebral circulation. The patient sits on a chair, the masseur standing behind. The thumbs of the operator in the median line of the forehead touch each other and the hands turned down rest lightly upon the temples. The stroke is made outward with the thumbs, proceeding downward from the median line over the cheeks and chin, stroking towards the angle of the jaws and following the jugular veins, press their contents with that of the accompanying lymphatics towards the shoulder joints, a continuous movement; kneading of the muscles of the cheeks, vibration over superorbital nerves and the pes anserinus follows and a gentle effleurage, closes the massage. To this may be added strong kneading of the muscles of the neck, a strong tapotement of the same muscles and rubbing and stretching of the cheeks by placing the thumb in the mouth, supporting the cheek, which is then gently rubbed by one or two fingers with a rotary motion and pulled and stretched, if indicated. Tapotement should not be given if it causes pain.

Massage of the head relieves headache due to various causes by improving the cerebral circulation and removing waste. It is of importance to make a correct diagnosis to treat cases of headaches rationally; that is, to treat the underlying cause of which the headache is a symptom. Headaches may be due to venous engorgement caused by a failing heart, to Bright's disease, arterio sclerosis or atheromatous, and also calcarious degeneration of vessels, syphilis, malaria, digestive troubles and constipation, gout, or rheumatism, migraine, primary and second-

ary anemias, chlorosis, etc. It would be irrational to rest by treating the headache, though in all these affections, massage is a valuable aid, helping to make the patient comfortable and relieving him of this distressing symptom. Neuralgias and neuritis, trifacial paralysis are well influenced by this method.

DISEASES OF THE HEART

The treatment of the diseases of the heart with massage and exercise has been developed by Oertel and Zander and the success of the treatment has long been shown to be effective. Oertel showed that the immediate consequence of a continuous exertion of walking, of hill and mountain climbing, is an increase of arterial pressure. A return to an equilibrium between arterial and venous pressure is the consequence—larger amount of venous blood flows into the right heart with increase of blood pressure and due to excitation of the depressor nerves, a widening of the arteries takes place, more blood flows into them, more heat is given off by the body, and heat production of the organism increased, due to processes of combustion during muscular exercise. An important law derived from these investigations is, that the increase of blood pressure is compensated by decrease of tone of vessel walls and widening of arteries.

The symptoms of the diseases of the heart and the insufficiency of that organ to perform its work, or to supply blood on demand, are the same, whether due to an organic valvular lesion or due to an idiopathic disease of the organ. The direct cause is the weakening of the heart muscle, and to fortify it and preserve its strength must be the object of all treatment.

Not the form, but the severity of the disease and the weakening and degeneration of the muscle, furnish the main indications for treatment. Saving and strengthening of the heart muscle is possible, and nothing else.

Valvular disease, that is the scars upon the valves of the heart that have formed after an inflammatory disease and have caused insufficiency or stenosis, cannot be restored to integrity, but the muscle may be improved and gain strength to compensate for the lesion and may be kept in good condition with proper treatment. If a valvular heart lesion has been contracted, the patient should be warned that he has lost a portion of his heart force. The heart muscle hypertrophies, just enough to supply the demand under these altered conditions. If the demand, and

with it the accompanying hypertrophy, are kept within reasonable limits by a judicious way of living, such a damaged heart may perform the usually required work up to an old age. Symptoms of insufficiency demand treatment and the earlier commenced, the better the prospect to restore the compensation more or less permanently. The success depends on many factors, the gravity of the original lesions, the willingness and capacity of the patient to carry out the directions of the physician, etc.

Functional disturbances of the heart and the fatty heart may be restored to perfect health. Affections of the heart muscles due to the diseases of the kidneys and vessels due to emphysema, etc., all may be treated by mechanical means. Improvement, that is, relief of serious and distressing symptoms, insomnia, dyspnoea, palpitation, etc., usually follow and finally may lead to perfect compensation, and in favorable cases to perfect health.

The weaker the patients, the more serious the disease, the more cautious and the more gentle has to be the treatment in the beginning, and gradually increased in vigor, as the patient improves.

The treatment is usually commenced with a gentle general massage, employing stroking, rubbing and kneading. Tapotement cannot be used in the beginning of the treatment and never with patients seriously ill. Edematous patients have to be closely watched and the heart's action and quantity of urine voided carefully controlled. Pain over the heart, anxiety and palpitation are often relieved by stroking along the intercostal spaces and vibration over the painful points.

Vibration over the back along the spinal column, as well as a light tapotement, slow pulse frequency. Such a treatment should not last longer than two minutes and should be used with caution.

A direct massage of the heart has been designed by Oertel. The patient sits before the masseur who places his hands lightly to the sides of the patient, the finger tips resting in the arm pits. He then, after a more or less deep inspiration of the patient, directs him to exhale slowly, and during the act of expiration allows his hands to glide downward and inward along a curved line, increasing more and more the pressure as the hands come downward till the thumbs meet at the ensiform cartilage. Without raising the hands, an outward movement of the wrist follows and both thumbs stroke along the border of the ribs with firm pressure. The hands at the same time compress the lower por-

tion of the thorax. With the beginning of a new inspiration, the hands glide back to their former positions to repeat the process. This direct massage to the heart muscles increases its nutrition by bringing fresh blood to the coronary arteries and by removing waste.

The expiration may be performed in two ways. This has been called by Oertel (Staccato breathing)—("Saccadirte Athmung") The inspiration preceding the expiration has to be deep and the first parts of expiration light, the second, follows with increased pressure. This causes the heart to be pressed twice during each act of expiration. This form of breathing must be used with the massage of the heart.

Exercise must be passive in the beginning of the treatment. Movements of toes and feet are followed by light movements of the arms; all to act efferent. A sideward movement of the arms widens the thorax and deepens respiration. The same movements may be made with the patient sitting, and active movements may follow. With returning strength, walking, and finally hill and mountain climbing is directed. The movements of the trunk, bending, etc., are usually contra-indicated—they tax the heart too much, and rising from the reclining position into the sitting posture should not be allowed.

Zander's apparatus is useful in the treatment of the diseases of the heart. It allows a gradual and steady increase, a certain dose, commencing with the lightest movements. In most cases this should be the method to be preferred if the patient can be treated in an institution equipped with the apparatus. As much may be done, however, by the physician, if caution, tact and good judgment are the guides. The exercises should be used daily to establish a habit and an increase should not be ordered until the patient is able to perform his task without inconvenience.

The exercises may then be increased in number, they may be executed with resistances of the masseur, or others, requiring greater strength, may be substituted.

Diseases of the kidneys are benefited by general massage and light exercise suited to each case, complicated as it usually is with the diseases of other organs. The quantity of urine is increased by general massage and edematous patients have to be carefully treated—too much liquid thrown at once into the circulation overtaxes the heart.

DISEASES OF THE LUNGS

The indications for the treatment of the diseases of lungs and pleura are many. In tuberculosis the mechanical treatment should be used with great caution. In the early stages before infiltration and destruction of lung tissue has taken place, it is beyond question the best and most rational method of treatment, and is the best prophylactic measure in this dreaded disease, provided that the treatment is conducted in a pure atmosphere. The lungs expand, the blood is aerated and purified, the pulmonary circulation improved and the bacilli have no chance to settle; and if they have entered, they are destroyed and carried away by the large quantities of blood and lymph that bathe the tissues. The matter is different in more or less advanced cases, with infiltrations and cavities. In these, massage and exercise may break up protective adhesions, and interfere seriously with the healing process. On the other hand it is necessary to aerate the blood and bring larger quantities to the diseased foci. The treatment of these patients is best commenced with rest in the recumbent posture, to ease the circulation and create a hyperemia in the lungs. The effect may be increased by placing bricks or blocks under the foot end of the bed. Quiet breathing gradually deepened, has to be practiced at the same time, and as improvement progresses, massage and exercise may be cautiously added.

Deep breathing and exercise are indicated in the treatment of old pleurisy and these patients improve as the compressed lungs expand. In the treatment of emphysema, one of the best methods is the compression of the thorax by artificial respiration and Oertel's massage of the heart. Chronic bronchitis is favorably influenced by this treatment. In bronchorrhoea it facilitates expectoration and removes mucus. Relief and improvement is also obtained in asthma by this method.

The breathing exercises, consist of deep breathing, with more or less forced inspiration and expiration. Five such deep inhalations and exhalations are followed by ten or more easy and quiet respirations, before another cycle of deep breathing of the same length is commenced. If this causes dizziness and discomfort, a pause has to be made, until patient feels comfortable.

To stop and to keep the air in the chest at the end of the expiration is injurious. It stretches the alveoli and should not be practiced. If it is desirable to force one side of the chest to breathe more deeply than the other, the patient is directed to

press his hand to the side, as in the wing position, bending over the same side, compelling with this maneuver the other side to breathe more energetically. This method is used in scoliosis, in old pleurisies, etc. There is not a form of exercise that does not influence the respiration and all may be used for this purpose. Deep inspiration, with bending forward compresses the chest and rising expands it; moving the arms away from the chest increases inspiration and returning them increases expiration, etc. If passive exercise is given it is best to use resistance during the treatment, less taxing to the patient. This is of importance in the treatment of the weak, but best observed in all. The breathing ought to be gentle, even and gradually deepened.

DISEASES OF STOMACH AND INTESTINES

In atony of the stomach, chronic gastric catarrh, and in various forms of indigestion and in dilatation, the mechanical treatment is useful. It is clear that cases have to be carefully selected and that an operation should be advised when obstruction of the pyloric orifice is great and the dilation advanced—in erosion, ulcer and carcinoma, massage and exercise are contra-indicated. Massage empties the stomach by pressing the food through the pylorus, increases muscular strength, diminishes the size of the organ and causes better functioning by improving the circulation. A gentle stroke passing from the fundus in a half circle towards the pylorus is followed by kneading, and vibration over the solar plexus follows. A light tapotement may be added and effleurage, as usual closes the treatment. Massage over the pit of the stomach should always be administered with caution. It may give rise to serious disturbances if this is not observed. Exercises that compress the stomach and improve the abdominal circulation are always indicated in diseases of this organ. These patients should be treated before breakfast when the stomach is empty, after a very light breakfast, or from three to four hours after the noonday meal.

Abdominal massage is an excellent remedy in chronic constipation, in fact it is the best, if there is no contra-indication for its use. Patients with sedentary habits, professional men, merchants and women that lead an indoor life, are often relieved by this treatment and the intestines may be trained to regular functioning. Atony and chronic intestinal catarrhs are benefited and in enteroptosis tone to the abdominal organs and muscles by

this method is enhanced. Its use is indicated as part of the general massage in chronic diseases, in neurasthenia and hysteria.

Thuro Brand advises the massage of the movable kidney and claims that this method will benefit it. The patient lies in a half-reclining position on his back, the knees lightly flexed, abdominal walls relaxed. The masseur stands between the legs of the patient or on his side, uses one hand, the left for the displaced right kidney to push it gently in place, and places the right hand over the back in the region of the kidney. He then conveys vibratory motions with both hands, directing the patient to raise the pelvis at the same time. If the left kidney is displaced the right hand is used to replace it and the left rests upon the back. Tapotement over the lumbar region and exercises to strengthen the abdominal muscles follow. In most cases of enteroptosis a suitable bandage is indicated, especially in those who have suffered from severe colicky pains. The bandages alone designed to support a movable kidney, have proven failures, as this cannot be done. Besides this organ is hardly ever alone displaced, but the condition is usually associated with a displacement of some or all of the abdominal organs. The pressure of the bandage must be upward and backward, a substitute for the abdominal muscles.

If massage is given for the treatment of chronic constipation, a difference has to be made between the spastic and atonic forms. In the former nothing but effleurage, a light stroking or rubbing ought to be used and even this should be done with caution. A contracted colon will often relax under gentle treatment and pains due to spasm may be relieved. On the other hand when the constipation is atonic in character the usual vigorous massage may be given with decided advantage.

If a tumor is palpable, the intestines have to be thoroughly cleared with enemas and castor oil, and if after these measures the tumor can still be felt, massage must not be given. *There are but few rare cases with palpable tumor in which abdominal massage is safe and beneficial and in these the diagnosis must be absolutely certain.* Even in fecal tumors massage is contra-indicated unless an inflammatory process can be excluded with certainty. Intestinal ulcerations, tuberculosis, cancer, syphilis, etc., contra-indicate massage.

Standinsky of Kiew, recommends abdominal massage contrary to the view of others in all diseases of the heart and claims that even arteriosclerosis is not a contra-indication for its use in

these cases. Dyspnea, palpitation and pain in the region of the heart, are often relieved. Patients with a broken compensation are benefited. The effect of the massage is similar to that of the carbondioxide bath upon the vascular tonus.

Abdominal massage is indicated in certain diseases of the liver and in combination with exercise will often perfect a cure. Functional disturbances of this organ, passive hyperemia, as well as cirrhosis, etc., are beneficially influenced by this method. The organ is emptied and freed from toxins. Conditions that contraindicate massage and exercise in other diseases of the abdominal organs are practically the same—as tuberculosis, abscess, carcinoma, etc. In biliary calculi and cholecystitis, massage if given at all, must be practiced with great care. An attempt to press the stone from the ductus choleduchus into the duodenum may cause perforation.

Thure Brandt describes a method useful in prolapse of the rectum: The patient rests in half-reclining position, the legs drawn up, knees lightly bent. The physician, or masseur stands at the right side of the patient and places his right hand over the region of the flexure and with the left passes it deeply into the small pelvis, grasps the flexure and raises it upward, making at the same time vibratory movements. Tapotement of the lumbar region and abdominal exercises follow: the physician or masseur, standing on the left side of the patient who rests in the former half-reclining position, grasps the flexure with one or both hands and pulls it upward and outward executing vibratory and shaking movements with both hands. Tapotement and gymnastic exercises as before follow. A short and deep pressure in front of the anus will occasionally reduce the prolapse.

Patients suffering from hemorrhoids are improved by abdominal massage, and a gradual stretching of the sphincter with dilaters or the procedure may be made more forcible with the fingers. This measure is often successful.

HERNIA

The treatment of hernia with massage and exercise is indicated when the patient will not submit to an operation or surgical measures, is contra-indicated for other reasons. Landerer mobilizes fixed hernias by placing the patient in bed with hips slightly elevated and after trying to mobilize and reduce the hernia with light pushing, pulling and kneading, he grasps the

intestinal coils above the hernia in a similar fashion, as the flexure is grasped in prolapsed rectum, and draws them gently into the abdominal cavity. This is repeated three times daily and a sand sack placed over the hernia in the meantime. Landerer reports good results. Reducible hernias are treated by tapotement, stroking, rubbing and kneading in the region of the hernia, pushing together of the opening and strengthening the abdominal muscles with exercise. Thure Brandt, after reducing the hernia, places his patient upon a mattress, with slightly raised pelvis, the legs hanging down over the border. The patient then stretches the leg and rotates it slightly outward. The physician takes hold of the heel and toes and directs his patient to raise the leg against the resistance of the operator. He then reverses the movement, directing the patient to press the leg downward against his resistance. This proceeding strengthens the straight abdominal muscles. To strengthen the oblique muscles he places his patient astride a bench, the feet fixed firmly upon the floor. The physician turns the shoulder opposite to the hernia, backward against the resistance of the patient and the physician making the resistance, the patient has to turn the same shoulder forward.

Abdominal massage is commenced with a light circular stroke from right to left around the navel to treat the small intestines, to be followed by a firmer stroke along the course of the colon. The masseur commences in the right iliac fossa, strokes along the ascending colon to the border of the ribs, across the abdomen along the transverse colon and down the descending colon, making deeper pressure when reaching the flexure and following it to the beginning of the rectum. This stroking has to be repeated a number of times to prepare for the rubbing. The left hand is gently but deeply pressed into the right iliac fossa, while the right hand, the finger tips of which rest over the fingers of the left hand, with these tips rub the ascending colon and gently but firmly push and press its contents onward along the course of the colon. This manipulation should not be repeated more than a few times. Or, the left hand is gradually deeply pressed into the region of the right iliac fossa, next the right is placed before the left in the same manner, then the left before the right, always gently pressing and pushing the colon contents onward. The rubbing and pushing has to be executed with greater force along the flexure, *the usual place where old fecal matter collects*. In some cases, especially in the treatment of the obese or of those with relaxed abdominal walls, these may be

grasped with both hands and pushed from side to side, moving the whole of the abdominal contents. Tapotement follows with the hand formed lightly to a fist, or with the whole hand slightly made hollow so that only the borders strike. Vibration, best with an instrument, and finally a gentle circular effleurage from right to left, close the procedure.

THE DISEASES OF THE NERVOUS SYSTEM

Massage and exercise are especially useful in the treatment of the paralyzed and should be commenced as soon as the acute condition following the stroke, has passed. Little by little the massage of the paralyzed extremities, consisting of stroking, rubbing, kneading and beating, the paralyzed limb, has to be increased in strength and duration. Passive exercise has to be added—active exercise follows as soon as the patient can execute the slightest movement. The treatment has to be continued and repeated daily, and exercise with resistance has to be given with returning strength in the paralyzed extremities. General massage should be added to the treatment to improve the general health of the patient.

The diseases of the spine are benefited by this treatment and in *tabes dorsalis* remarkable results have been obtained, though doubtless in many reported cases its effect has been exaggerated. Massage relieves the distressing neuralgic pains from which these patients suffer, the lancinating, cutting pains of the legs, the girdel sensation and the gastric crises. These pains are often due to vascular spasms, and massage is effective by relieving these spasms.

Effleurage, petrissage and vibration are agreeable to the patient. Tapotement is best not given, though occasionally it may be of benefit. The bladder is strengthened by careful massage and constipation is often relieved.

Stretching of the spine is beneficial in some cases. The extension and suspension with apparatus, once very popular, has been completely abandoned. If the stretching is used it has to be done with great caution.

Exercises were in vogue since tabetics have been treated, but it remained for Fraenkel to work out a system, and to point out the great value of methodical exercise in the treatment of this disease. Patients that are confined in bed, unable to make any co-ordinate movements, may learn to walk and to use their

hands. Graeupner has introduced linoleum runners upon which squares are printed. The patient is taught the simple positions of the foot upon this runner, first, when sitting, next standing, first with the right, next with the left leg. The squares are marked one—two—three, etc., and the patient executes the position upon the command given by the physician. The exercises are then practiced with closed eyes, and finally the patient has to give the command himself. He is then taught to rise from a chair, to stand up and to walk, the physician guiding the patient, walking along with him and demonstrating the step. He has to learn to place his feet inside the marked squares and later the stiffness of legs and inability to bring the heel down are corrected. The patient is taught to raise the thighs, press down the toes and turn the foot outward until finally he resumes a normal walk. In a similar way, with suitable exercises, the ataxia of the upper extremities is to be corrected. The patient taught to use his eyes to regulate co-ordinate movements regains the use of his extremities. Exercise should never be made alone by the patient to avoid injuries. Atrophies due to the tabetic process have to be treated with massage.

That massage and exercise are valuable aids in the treatment of the functional neuroses, hysteria and neurasthenia has been stated before. Weir Mitchel's plan to treat these patients with massage, electricity, rest and feeding is now generally known and frequently employed. It is known as the "Weir Mitchel Rest Cure". The patient is kept in bed, with a trained nurse to wait on him. Every day general massage of an hour's duration is given in the morning, preceded by a warm bath. Electric treatment may be added. Every three or four hours easily digestible, but very nutritious food, is given. This should consist of milk, eggs, cream, butter, etc. The treatment is continued from four to six weeks and best followed by a trip to the seashore or mountains.

It should be remembered that neurasthenia is often the beginning or masking of a serious organic disease and paresis has been treated for neurasthenia.

Massage and exercise are good in all other diseases of the nervous system and in paralysis agitans and in chorea much can be done with training and improvement of the general health.

NEURALGIAS

Neuralgias are always benefited by mechanical treatment—light, deep stroking and kneading of the affected nerves, and pressing, rubbing and vibration of the painful points along the

nerves, relieves and frequently cures. In fact it is often the only means of permanent relief. Adhesions are loosened, exudation of blood and lymph absorbed, toxic substances removed and a perfect circulation re-established. The treatment of the sciatic nerve is commenced with effleurage of the whole leg, the patient lying on his stomach, the leg stroked from the ankle upward, ending over the gluteals, with a firm circular stroke around the joint. The muscles are then deeply and thoroughly kneaded in the same turn, and the "Kammgriff" follows. Rubbing and boring down with the finger-tips to the nerve and vibration along its course, especially over the painful parts, usually the points of exit in the gluteal region, and over the superficial position in the hollow of the knee is then applied, best with the vibrator and a closing light stroke to soothe. After this procedure, the nerve is stretched. The patient is directed to lie on his back with stretched leg. The physician grasps the affected leg by the heel and raises it stretched, bending it in the hip-joint, as far as it will go without causing pain. Bending forward, and all other trunk exercises that cause a stretching of the nerves, are beneficial, though they should be practiced with caution, to avoid injury. Every constitutional cause that may form the basis of a neuralgia, like syphilis, malaria, alcohol, nicotin, gout, diabetes and constipation has to be treated and the diagnosis has to be carefully considered, especially in diseases of the central nervous system. General massage should always be combined with the treatment of a special nerve.

MASSAGE OF THE BLADDER AND OF THE GENITAL ORGANS

Massage of the bladder has to be given with great caution and is only permissible when the passage of the urine is not obstructed, such as in cases of atony and dilatation due to prostate hypertrophy, etc. In these cases a gentle circular stroke over the bladder has been found of benefit and gentle stroking and pressing, after introduction of the catheter, will often cause contraction and emptying of the organ, when a momentary parietic condition of the muscular coat prevents it. Expression of the bladder by grasping it, after Credé's method, is dangerous and might, in cases of prostrate hypertrophy and stricture, cause rupture when, as is frequently the case, diverticles are present, consisting only of thin mucous and serous membranes.

In strictures of the urethra, massage is beneficial. The stricture is lightly rubbed with the finger tips once a day and after passing the sound, the instrument is cautiously and gently pushed forward and backward. Rotary motions must be avoided as they may loosen and tear the mucous membrane.

Prostate massage is very popular and affords relief in many cases. To treat a hypertrophic prostate, two fingers are inserted into the rectum, after thorough cleansing of the canal, and the gland is then stroked and pressed from the median line outward to both sides, especially over its prominent portions. In incontinence of urine, the neck of the bladder may be treated by massage through the rectum and this method gives good results in some cases.

MASSAGE AND EXERCISE IN GYNECOLOGY

Massage of the uterus and its adnexa has been introduced by Thure Brandt and is now uniformly used in gynecological practice. Indications and contra-indications for this method do not differ from those of other organs. In malignant and tubercular processes, syphilis and gonorrhea—in fact in all infectious conditions where the danger of causing a spreading of the virus exists—massage is absolutely contra-indicated. General peritonitis and death may follow its application in such cases. Rise of temperature is a sign to stop the treatment at once, and not to commence it until the fever has passed for weeks.

Massage is indicated in the treatment of old adhesions and scars, chronic metritis, displacement of the uterus, atrophy of that organ, dysmenorrhoea, metrorraghea, etc. There is, however, hardly any method of treatment that can do so much damage as gynecologic massage given without a correct diagnosis.

The proper mode is as follows:

The patient lies in a half-reclining position, head supported to push the chin towards the chest, the legs slightly drawn up and lightly bent in hip and knee joints and the feet supported. This position is the most favorable to relax the abdominal walls. The physician sitting on the left side of the patient passes his left arm under the thigh and introduces one or two fingers of his left hand, well covered with vaseline, into the vagina. The thumb is abducted, the third and fourth fingers rest upon the perineum, the fingers introduced fix the parts to be treated and press them steadily, but gently towards the right hand, which from without, between

navel and pubis, presses gradually downward, so that the diseased portion of the uterus is touched by the finger-tips of both hands. Stroking, kneading and rubbing is done with the right hand. It is of great importance to keep the fingers within the vagina perfectly steady to prevent sexual excitement. The patient is directed to breathe quietly to prevent tension. In some cases it may be necessary to give the massage with the fingers in the vagina and to use the right hand to fix the diseased part. In this case, it is necessary to keep from touching the clitoris. Just as in other cases, the massage should be commenced lightly and more in the neighborhood of the diseased region, until acute pain is stopped, then to give it over the diseased part itself, and gradually increase in vigor. A gentle circular stroke, a light stretching, kneading and vibratory motion, followed by gentle effleurage, are the usual manipulations.

Exercises follow massage. They should be designed to improve the pelvic circulation and strengthen the muscular apparatus. The patient, lying flat upon a hard mattress, slowly raises the pelvis, supported by shoulders, elbows and feet, spreads the knees, and brings them together against the resistance of the physician. Movements with legs and feet, raising of the legs to create a hyperemia in the pelvis, etc., may be directed. Tapotement over the lumbar region and effleurage follow. Manipulations of gynecological massage have to be varied and suited to the purpose. If displacements of the uterus are treated, it is necessary to soften the scars first by rubbing, stretching and stroking, before placing the organ in the normal position. The right hand upon the abdomen grasps the fundus and moves it in the desired direction, supported and aided at the same time by the fingers of the left hand in the vagina; or the physician introduces the right index finger high into the rectum and with the thumb of the same hand in the vagina replaces the uterus by pushing the fundus forward with the index finger and the cervix upward and backward with the thumb. The index finger and thumb of the left hand may be used in the same way. After replacing the womb, the organ and ligaments are treated with massage. Prolapse of the uterus may be treated with massage and must be preceded by replacing the organ in the normal position. An assistant is necessary for this treatment. Surgical measures are preferable in severe cases—an enteroptosis correctly treated relieves the uterine condition, if not too far advanced. In incontinence of urine in the female the urethra is treated

successfully in a number of cases by massage and following Saengers' method, may be gently rubbed forward and backward, with a sound introduced.

DISEASES OF THE EYE AND EAR.

In diseases of the eye, ear, nose and throat, massage is constantly used, and with it relief and cure of many affections have been obtained. Unskilled hands with an incorrect diagnosis can, however, do the greatest harm and the method should be used only by the specialist.

MASSAGE AND EXERCISE IN SURGERY

Mechanical therapy can be used with advantage in any injury. Its object is to cause absorption of exudations, prevent stiffness of joints, atrophy of muscles, and in old injuries cause absorption of edemas, restore atrophied muscles, stiffened joints, soothe and stop pain. Bruises and other injuries to muscles, fasciae, vessels and nerves, without an open wound, are especially well suited for treatment with massage. Surgical measures should not be neglected and a correct diagnosis precede the massage treatment. The method has been used in these conditions since time immemorial and is popular today. A simple stroking and kneading will cause rapid absorption of exudations of blood and lymph and stop pain. The massage is commenced very gently around the injured part and gradually, as pain lessens, increased in vigor and strength, and extended over the seat of the injury. Simple hydrotherapeutic measures or Priesnitz bandages and a few days' rest in bed with fixation of neighboring joints will assist the healing process. Atrophy, muscular rigidity and muscular rheumatism are often benefited and cured with mechanical treatment. In many instances of muscular pain, this treatment will facilitate and cause elimination of poison and stop pain without danger to the organism. The muscles are stroked lightly, and pressure gradually increased, deep kneading, tapotement and passive and active movements follow. Movements must be selected to stretch the affected muscles. Patients suffering from lumbago have to bend forward and while executing this movement, effleurage, petrissage and tapotement are continuously applied. Stretching and tapotement are important manipulations in treating muscular affections and are supple-

mented by exercises for paretic and paralyzed muscles. In the beginning of the treatment, gradual resistance of the movements by the patient is necessary. Tapotement causes muscular contraction and acts like an interrupted current.

Writers' and pianists' cramps are due to overwork and exertion of certain groups of muscles caused by continued repetition of the same movements. The symptoms consist of fatigue and weakness of these muscles. Two forms are known—the spastic and the paralytic form. In the former, irregular spasms interfere with the writing, or prevent it entirely, as soon as an attempt is made. In the paralytic form, a sensation of intense weakness and fatigue drops the pen after the first few strokes. In both affections, pains are felt in fingers and forearm, frequently radiated upwards into the shoulder joint.

The treatment is commenced with effleurage, the muscles of every finger of the hand, the forearm, and further up to the shoulder, are thoroughly stroked and pressed. Deep kneading follows. The ball of the thumb and little finger, the interossei, and the muscles of the forearm, up to the shoulder, are treated with a thorough petrissage. It is well to knead and press and rub each muscle separately. The same muscles in the same cycle are then energetically beaten. The beating has to be strong and elastic, but should not cause pain. The interossei are beaten in the manner of a rapid percussion, with the tips of the fingers. The larger muscles are beaten with the ball of the little finger, the hand bent lightly to a fist, or the fingers spread fan-like, as described previously. The affected muscles are then stretched and gently pulled. The hand is bent upward and downward, the fingers are bent and stretched, spread and closed, until every muscle and tendon has been treated in this way. Effleurage and active movements are added. The treatment should be given twice a day, each lasting only a few minutes. Movements with resistance are of great value in these affections, the resistance being gradually increased as strength returns.

The usual occupation of writing, playing the piano, or violin, are then commenced, a few minutes at a time, and gradually increased in duration. With recovery the treatment, is lessened in time and frequency.

STRAINING AND DISLOCATION

A differentiation between Distorsion and Dislocation must be made beyond all doubt. Fresh distorsions have to be treated with effleurage, beginning very lightly and then increasing pres-

sure as pain lessens. The stroke has to be extended over the neighborhood of the injured joint; of foot and leg, up to the knee, of hand and arm, up to the elbow. Rubbing, kneading and tapotement follow. Effleurage closes the manipulation. Massage must relieve pain and not cause it. This is of importance to remember. Passive movements have to precede the massage for diagnostic purposes. They have to be made very gently and the joint has to be moved in every possible direction. If there is the slightest crepitation noticeable, the injury has to be treated as a fracture. Passive movements have also to follow the massage, and active movements should be commenced as soon as the acute condition has passed and a fracture can be excluded with absolute certainty. In cases of doubt, a Roentgen Ray diagnosis should be made. Active movements are very painful in the beginning, especially walking after injuries to the ankle joint. A chair has to be used or an assistant has to support the patient in the first trials. Too much is injurious and the physician has to use a great deal of judgment and must be guided by the feeling of the patient. Massage should not last over five minutes and should not be repeated more than three times daily. A combination of various methods of treatment, especially an addition of hydrotherapeutic measures, is often indicated.

The treatment of old injuries does not differ from the above except in strength. The various manipulations, stroking, rubbing, kneading and tapotement all may be given with greater vigor and passive movements with greater force, though brisk and violent movements should be avoided.

Abnormal movements in distorted joints mean tear of tendons. The joints have to be treated with fixation, though massage is indicated. Exercise should not be given until abnormal movements of the joint have become impossible. In order to make fixation and massage possible at the same time, the bandage must be so arranged that it can be removed and replaced whenever the one or the other measure is desired. For instance, a plaster bandage may be split after drying, massage administered and the bandage replaced.

DISLOCATIONS

A dislocated joint has to be put in place and fixed and kept in position for about eight days. It is of great advantage to place the bandage so as to leave the joint free. Massage may then be given in the neighborhood and over the joint itself.

It is best to commence gently and lightly and to gradually increase the manipulations in strength and vigor. After a week the bandage may be removed and gentle passive movements may be commenced, though the injured extremities have to be supported for some time. Following the same plan, active movements are gradually introduced. In cases of dislocation in which small pieces of bone are broken off, the time of absolute fixation of the joint should be at least ten days and massage should not be given over the joint during this time, though it may be given in the neighborhood of the seat of injury. Every manipulation—stroking, kneading and passive movements—has to be commenced with great gentleness, and force increased with caution. In old dislocations a replacement has to be tried and if successful they have to be treated as fresh dislocations. If a replacement is not possible a false joint should be created by moving the extremity in the various possible directions of a sound joint and strengthening the muscles by kneading and by tapotement.

FRACTURES

Massage may be used with advantage in the treatment of fractures. Callus forms under its use more rapidly and the tendency to callus hypertrophy is lessened, muscular atrophy and joint stiffness may be in most cases entirely prevented and the time of healing considerably shortened. The treatment is commenced with a perfect reposition of the fracture and fixation by simple splint, well upholstered with cottonwool. In fractures of ulna and radius the fingers are left free. After four or five days the bandage is removed and if the fracture is found still in position, the splint is shortened at its lower end, so that the metacarpophalangeal joints are free. The patient is then directed to move his fingers. After three or four days more, the splint is entirely removed and a thorough treatment with massage commenced. Stroking, kneading and tapotement of the forearm and movements of finger joints and wrist are resorted to. Fractures that are wedged in, and in which reposition is impossible, must be treated from the very beginning with massage, to cause absorption of blood exudation, prevent callus hypertrophy, muscular atrophy, and joint stiffness. In fractures of the ankle, the joint, after perfect reposition, is fixed by a well upholstered plaster bandage. In four or five days the bandage is replaced by another plaster bandage, but instead of using cottonwool, the joint is

covered with a light layer of flannel. This second bandage is kept up to the tenth day of treatment, carefully split and opened and the leg treated with massage and passive movements. The bandage should be replaced and the treatment repeated twice a day. After a few more days the patient should be allowed to walk with crutches. Finally, the plaster bandage is only used at night, and a simple bandage during the day. After three to four weeks from the date of fracture, the patient can, as a rule, use his leg fairly well. The length of time of massage, the gradual increased vigor of the movements, and the cautious beginning of the walking exercises must be left to the judgment of the surgeon.

Fracture of the kneecap is especially suited for this treatment, with the exception of those cases that need an immediate bone suture. Massage may be commenced after injury. The whole joint is treated with stroking and kneading and the quadriceps treated with a more vigorous massage and tapotement to prevent atrophy. After the treatment, which should last from ten to fifteen minutes, the joints are well bandaged, the fragments pulled together and the leg placed in a raised position. This treatment is given once or twice a day and after from five to six days the first walking exercise, with the knee well bandaged, may be made. Bony junction is rarely obtained with this method, but the function of the leg is kept and atrophy of the quadriceps prevented. Passive movements of the knee joints are contraindicated in fracture of the kneecap.

All fractures may be treated in a similar way and the same advantages, such as shortening of healing time, rapid absorption of callus and blood exudation, prevention of muscular atrophy and joint stiffness, are obtained.

Inflammations of joints, when acute should never be treated with massage. The rule not to bring anything into the circulation that might do harm, must be borne in mind. Tubercle bacilli, spirila, gonococci, streptococci and staphylococci, might be driven into the lymph channels and cause serious local or general infection. Massage of tubercular joints may lead to suppuration and pulmonary tuberculosis. Only when acute symptoms have entirely passed and after taking everything into consideration, massage may be used to improve the condition. The treatment requires an exact diagnosis. It will never give good results, if the cause is not removed.

Arthritis deformans and chronic rheumatism are affections that will be benefited by this treatment, though it is slow in its effect and takes a great deal of patience, both of the physician and patient. The differentiation is difficult to make. Roentgen Ray examination will aid, as will ankylosis in chronic rheumatic affections. Loosening of the joints in rheumatoid arthritis, is the rule. The treatment is generally commenced with passive movements. The joint is moved in every possible direction, and gentle stroking gradually increased in strength and extended over the joint, follows. The joint is then grasped with both hands and its contents pressed upward towards the center, the hands gliding back in position to repeat the process. The thickened capsule may be rubbed against the underlying bone.

Atrophied muscles have to be treated in the usual way, with effleurage, petrissage and tapotement followed by passive and active movements. Rough treatment is injurious in every case and the more gently and elastic is the massage, the more judicious the exercise, the greater the benefit derived from the method.

Extension and fixation of the joint after massage is frequently indicated to relieve pressure of diseased surfaces upon each other and a moderate extension of a diseased joint will often stop pain immediately. Joint inflammations due to trauma are well suited for treatment with massage and hysterical joint affections are occasionally cured by it. A diagnosis is not always easy to make. If the temperature rises during the treatment, the diagnosis has to be corrected. Operations have been performed on hysterical joints, and others apparently hysterical, have turned out to be tubercular after one or two years. Stiffened joints have to be loosened. The successful treatment of stiffened joints will prevent ankylosis.

Each person uses in everyday life only a certain set of muscles and joints, which invariably leads in later years to dry catarrhs crepitation, stiffened joints and atrophy of muscles. To prevent this and keep in good health, room-gymnastics, morning and night at least three or four times a week, designed to use every muscle and joint of the body, with healthy outdoor sport, walking, horseback riding, tennis, golf, etc., are the best prophylactic measures, if suited to age and state of health and never carried to fatigue or exhaustion. If this precaution is not observed, the practice will do more harm than good.

Stiffness resulting from acute infectious diseases, especially after inflammatory rheumatism and stiffness due to disuse after

fracture and bandage caused by atrophy of muscles, may be entirely cured with mechanical treatment. Massage suited to each case, followed by passive and active movements, is the remedy. If the process has progressed to ankylosis, that is, if the joint has been immobilized, a careful diagnosis has to precede the treatment to settle the question whether the ankylosis is due to the disease of the joint itself or due to contractures and whether due to fibrous or bony ankylosis, that is, whether the immobilization of the joint is caused by fibrous or bony union. Tuberculosis and osteomyelitis cause bony union and the mechanical treatment is contra-indicated in such cases. Forcible extension of an ankylosis may be made under chloroform or ether narcosis. It has to be done carefully and slowly with an assistant, to avoid tearing of structures of tendons fasciae and muscles, even bones may be fractured by sudden forcible extensions. The bones are usually brittle in these cases. After extension, the joint is well wrapped in cottonwool and fixed by a splint; a plaster bandage to be removed and replaced, if pain and swelling follow, should be used. Treatment with passive movements and massage is commenced as soon as the acute process has passed, a few days after extension if the upper extremities are diseased and when it is possible and desirable to make a movable joint. An ankylosis in corrected form is usually the best if the lower extremities are the seat of disease. Operations are only permissible when the mechanical treatment is contra-indicated and the joint is fixed in such a position as to make it useless.

False and loose joints following after polyomyelitis anterior, rachitis, trauma, destruction of joint cartilages and insufficient formation of callus in fractures, demand a mechanical treatment. Loose joints due to rachitis have a tendency to improve with time, resulting in the healing of the rachitis. If due to polyomyelitis, apparatus has to be used combined with energetic massage to strengthen the atrophied muscles, though this fails occasionally and an operation fixing the tendon of a healthy to the atrophied muscle, or an ankylosis of the joint may become necessary.

If cartilages have been destroyed, as it happens in arthritis due to tabes or rheumatoid arthritis, a supporting apparatus is usually indicated in combination with massage, to counteract muscular atrophy, and, if insufficient callus formation is the cause, the fracture has to be carefully examined. The contact of the fractured surfaces may be found imperfect, interposition of muscles or an insufficient fixation, etc., may have prevented an

osseous union; or a constitutional cause may be at the bottom of the trouble. Age, syphilis, tabes and other diseases of the nervous system, cachaxias, etc., all may interfere with the healing process. Local tubercular, syphilitic and malignant processes have to be thought of. Deep and energetic massage direct to the bone is the remedy in cases of none or imperfect union. The fracture surfaces have to be rubbed over one another and fixation has to follow the treatment. An early application, especially in fractures of the leg, well fixed in plaster bandage is indicated and will often cause perfect union. Operation is necessary when mechanical treatment does not succeed.

The mechanical treatment is the treatment par excellence in orthopedic surgery. However, it requires a great deal of special skill and apparatus and is, therefore, left to the specialist.

If we sum up we find massage and exercise a method of treatment of the greatest value that can be used in almost every disease and that can be continued until the object in view is reached, without harm, no matter how long it may take. The immediate effect of massage is to increase elimination and improve the composition of the blood by freeing it from toxic substances and to bring larger quantities of the purified blood where they are needed to effect a cure.

CHAPTER VI

HYDROTHERAPY

Hydrotherapy means a methodic application of water to various temperatures for dietetic, prophylactic and therapeutic purposes. In order to use this powerful method intelligently, it is necessary to understand the action upon the healthy organism. The organism is surrounded by air, the temperature in immediate touch with the body varying, according to a number of observers, from 33° to 36° C. Rubner states that man dresses so that the heat he loses corresponds to a loss he would sustain naked at a temperature of 33° C. The skin acts as a protective covering, defending internal structures from external violence mechanically and essentially as a great complex organ of sensation.

The application of water causes a sensation of touch and temperature and produces slight irritation by chemic action. In some instances this action is increased by the addition of various salts or mustard; in others it is decreased by the addition of bran or slimy substances. It is at once clear that all these factors act in unison and that we never can produce with water application a sensation of temperature alone without producing a sensation of touch as well, though according to the mode of application we use, either the one or the other may be predominant.

Mechanical irritation is slight in a simple bath, but becomes powerful under a douche. The temperature of the water may be varied to suit the purpose, and this is by far the most important factor in hydrotherapy, because the water can be employed as a heat-carrier at any degree of temperature. The chemic properties of water are only of great importance when used for internal medication.

Another factor of importance is the study of water as a therapeutic agent, in that, with each application we either add heat or abstract it from the body. In order to keep its temperature permanent the organism will increase or decrease heat loss, and if this is not sufficient, heat production. The former is of a physical nature, the latter is a purely chemic process. We may then say that the effect of water upon the organism is due to the changes it produces as an irritant and causes by its abstraction or addition of heat.

Investigations have shown that certain nerves convey heat and others convey cold. The sinking of the surface temperature, therefore, acts as an irritant for the cold-conducting nerves and a rise in surface temperature as an irritant for the heat conductors. It is within the experience of everyone that a quick change of temperature will increase the effect and a gradual change may decrease it to such an extent that it becomes almost unnoticeable. Absolute temperature and mode of application may cause an entirely different effect, and the modifications that can be produced by varying one or the other factors are innumerable. The surface of the body subjected to the procedure influences the result, as is well shown by Weber's experiment. If we immerse the index finger of one hand and the whole other hand in hot or cold water, we find that the sensation produced is not the same, but the water touched with the whole hand feels warmer or colder, the sensation being of greater intensity. Treating a larger or smaller surface will change the effect, and the intensity will be proportionate to the size of surface. However, the final result further depends on the particular place irritated and the state of the nerve termini in the skin after various irritations have preceded it. It also changes in the individuals to such an extent that the same application may produce severe pain in one person while in another it will call forth only an agreeable sensation. The addition of mechanic and chemic irritants may still further enhance the effect.

A consideration of these points will enable us to produce for practical purposes the effect needed in each case, from an almost insensible irritation to a shock.

A consideration of the effect of hydrotherapeutic measures upon the various organs and structures of the body will show that we can greatly influence the circulation, producing hyperemia and anemia at will. For instance, an icebag applied to the cutaneous surface causes an impression upon the terminal nerve endings, sensory impulses are conducted at once to the central nervous system, which in turn sends reflexes, influencing every function of the body. The direct effect of cold upon the vasomotor nerves produces a narrowing of the capillaries and raises blood-pressure by offering resistance to the current. The muscles contract and the bloodless, pale and flabby skin shows the picture of a "cutis anserina". This is followed by dilation of the capillaries and reddening of the skin, which becomes cyanotic if the application is not removed. When the icebag is removed, the pallor lasts for

a little while; this condition is followed by dilation of the vessels and the skin shows a healthy glow, accompanied by an agreeable sensation of warmth.

If heat below 40° C. is applied, the dilation of the vessels and reddening of the skin occurs at once, and gradually becomes more intense. The application of great heat will cause immediate paling, followed quickly by reddening. This persists for some time after the application has been discontinued.

Though heat and cold act in an entirely different way, both produce an active hyperemia, that is, one due to arterial dilation in contradistinction to passive hyperemia due to venous stasis. Both act directly and by reflex. Hyperemia is accompanied by increased, and anemia by decreased volume. These changes influence the blood distribution throughout the body. Winternitz observed an increase of volume in an arm placed in a plethysmograph during a cold sitz-bath and a decrease during a short sitz-bath. Schuller's experiment on the rabbit shows a dilation of the pia vessels on application of cold to the abdomen and contracting on application of heat. In general we can say that the vessels of the internal organs, and especially those of the abdomen, possess an antagonistic, compensatory action to those of the skin. The vessels of the organism never contract or dilate at the same time.

Being able to control circulation, we can relieve congestion, and inflammation by causing contraction of the vessels in the inflamed portion and by diminishing the blood supply, or cause hyperemia. Priessnitz taught that inflammation of feet and hands should be treated with cold applications to the knee and elbow; those of the head with application to the carotids. We can make the meninges anemic with a hot foot-bath, this result being due to reflex action. The vessels of the skin can be filled, influencing thereby the circulation of the internal organs. We can exercise a similar influence upon the abdominal vessels, emptying and filling them by causing them to contract or to dilate, thus influencing the circulation in other organs. This is not all that can be done with hydrotherapeutic measures, but with them the very composition of the blood can be changed. Winternitz was the first to observe that after a cold bath the number of red cells and white cells was enormously increased, the former up to 1,860,000, and the latter up to 25,000. These observations have been confirmed since by many observers. This extraordinary change also observed after muscular work, is due to the improvement of the circulation. The cells though formerly present are

by means of these applications thrown into the general circulation. They disappear after a short time, but so long as they circulate they function and improve metabolism. Warm and hot baths and the steam bath diminish both corpuscular varieties.

The heart can be influenced directly by cold and hot applications. Clinical experience has shown that after suitable hydropathic measures, dilated hearts decrease in size and show improved functioning. Cold applications slow the pulse and hot applications increase its frequency. A cold bath increases blood pressure, and a warm bath diminishes it. The heart answers promptly greater demands with increased work, and the secondary hyperemia of the skin following the cold bath means improved circulation. Valvular disease insufficiency of valves, has been and is treated successfully by hydrotherapy. Carbondioxide baths, which cause increased pressure and force the heart to work at the same time, cause vasomotor changes which are beneficial to nutrition. Man, as well as all mammalia, keep the same temperature under all climatic conditions, notwithstanding the fact that the same physical laws that govern inanimate nature governs the animate; that is, cold lowers the body temperature and heat raises it. If the body produces more heat than is necessary to keep its temperature constant, it will correspondingly lose it. For instance, during great muscular activity, the peripheral vessels dilate, the skin becomes red and warm, and gives off more heat by radiation and conduction, by sensible and insensible perspiration, and this process is further aided by rapid and shallow respiration of the lungs. If heat abstraction surpasses the usual rate, the peripheral vessels contract, the skin becomes bloodless and heat radiation, conduction and perspiration are limited. If this physical process is not sufficient, heat production will be increased and this is done by muscular contraction.

If in a cold bath we keep the surface vessels dilated by friction, we can abstract heat without increasing production, the cooled blood returns and lowers the temperature of muscles and organs, and reflexes are minimized. We can understand now why two baths given at the same temperature and of the same duration may have an entirely different effect. In the first we lower body temperature by keeping the peripheral vessels dilated, and in the second we cool down the surface and stimulate heat production. If we bear in mind that by controlling the mechanical means, blood distribution, heat loss and heat production, we improve temporarily the composition of the blood and create an artificial

leukocytosis—so important in typhoid fever and other infectious diseases—we find that in hydrotherapy we possess a sovereign remedy for the treatment of all febrile diseases. Considering the influence hydriatic measures exercise on the respiration, we see that a hot or cold application is followed by a deep inspiration and a short apnea which is followed by a deep expiration, and the respiration is then lastingly deepened. The inhalation of oxygen and exhalation of carbondioxide are increased, and as this depends entirely on chemic processes carried on in the cells, we see that these measures influence the internal as well as the external respiration. Experience has shown that cold application to the neck especially increase the depth of respiration, and as this is accompanied by a narrowing of the pupils, it is believed that its cause is a direct irritation of the medulla, though no doubt the increased amount of carbon-dioxide in the blood is an additional factor.

Skilled application will increase function, strengthen enervation and change circulation. The regeneration of cells can be directly affected. Constant heat application causes arterial dilation, and in consequence a more rapid growth of tissue. Cold slows growth and may lead to necrosis. Pensold's experiments on animals have shown that heat increases tendency to heal. Secretions and excretions are altered. A larger volume of urine is voided after each bath, warm or cold, and the desire to urinate is pronounced in a warm bath. A bath that causes perspiration diminishes the amount of urine, if the water ingested is not increased. In the treatment of heart disease with the cold bath, in combination with carbonic acid, an early symptom of a re-establishment of compensation and an improved circulation is the increased amount of urine voided. Uric acid excretion after a hot-air bath may be increased to one per cent. in twenty-four hours. It must not be forgotten that hemoglobinuria and passing albuminurias have been observed after the cold bath and that the hot bath has caused albuminurias as well as glycosurias. Cold and hot applications, or better still a combination of both, increase the flow of bile. This is thought to be due to an improved portal circulation, a stimulated intestinal peristalsis and an increased diaphragmatic contraction. Digestion is improved, appetite increased. A change in the character and amount of gastric secretions has been many times observed.

The alteration that may be caused by hydrotherapeutic measures in the functioning of the skin is even more evident,

because these changes are visible and the process of perspiration has been well studied. For practical use, thermic measures are employed to cause profuse perspiration in order to obtain an entire change of water excretion, and with it the process of diffusion taking place in the internal organs causes an entire change of blood distribution and a ridding of the organism of noxious substances with sweat excretion. Though perspiration as a rule contains only 0.2% to 0.4% inorganic substances, mostly sodium chlorid and potash, traces of urea, fatty acids, aromatics and various gases—of which carbondioxide should be mentioned—and pus bacteria, have been found. Drugs excreted with sweat, are mercury, potassium iodid and arsenic. That cold applications strengthen the muscles and warm applications tire and relax them, has been shown. This has been demonstrated exceedingly well by the curves constructed by Vinnay and Maggiora. These authors also show that a similar effect can be obtained by massage. The effect of water applications upon the nervous system is of great interest. They may act directly or by suggestion. An application of cold may remove depression and awaken consciousness from a deep syncope, while a like application under other conditions may cause shock and syncope. A cold application is followed by gradual reaction and an agreeable "bracing" sensation, a warm application by a tired feeling and by sleep. Cold applications may cause complete anesthesia and analgesia, and hot applications are employed constantly to alleviate pain. Lost patellar reflexes have been restored after cold applications, and tactile sensation has been modified. Hydrotherapeutic measures act by suggestion through the general refreshing or tiring sensations they produce, through immediate removal of hysteric symptoms and educationally by teaching the patient to endure disagreeable sensations in order to obtain beneficial results.

It is of interest to note generally the prompt action of a warm bath as a sleep-producer. Many theories have been advanced as to the physiology of sleep. Physiologists agree that the proximate condition of sleep is a slowing of the cerebral circulation. The circulation is retarded during sleep, the number of pulsations is reduced and the combustion of the economy is slowed, the cerebrum also taking part. Remembering this we can readily understand why a warm bath is a true hypnotic.

After a treatment with water, patients with a very sensitive skin may suffer occasionally from eczema and uticaria, especially

after a combination of mechanic and thermic applications. A free use of ointments or powders may prevent these disagreeable reactions. An addition of bran or slimy substance acts sometimes as a prophylactic. Furunculosis, acne, herpes-tonsurans and other parasitic infections can be prevented by strict attention to cleanliness. There are some very sensitive individuals who have an idiosyncrasy to cold water applications and in whom they react with profound and lasting cyanosis. It is dangerous to treat such patients with hydrotherapy. By acting upon the nervous system, we influence the circulation and change the composition of the blood. The functioning of every organ of the body may be improved. A hyperemia may be created whenever needed and portions of the body as well as the whole organism freed from waste matter and from toxic substances by hydrotherapy.

THE COLD BATH

The tub is filled with water of a temperature from 50° to 60° F. (Figure 2)

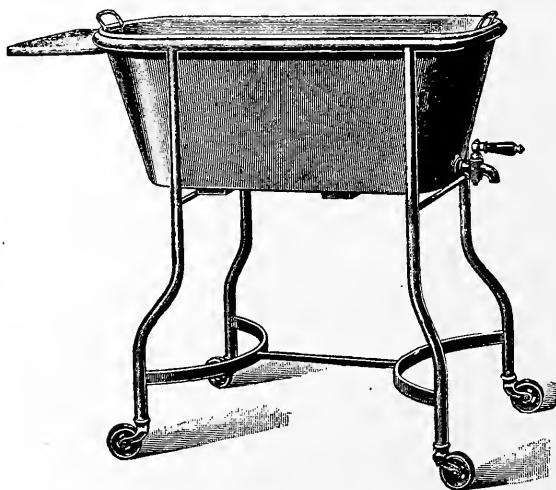


Figure 1—Bathtub For Children

In the South, ice has to be added during the larger part of the year to give the water this desired temperature. The bath is best taken before breakfast. The patient enters it on rising. Everyone is familiar with the sensations produced. A shock,

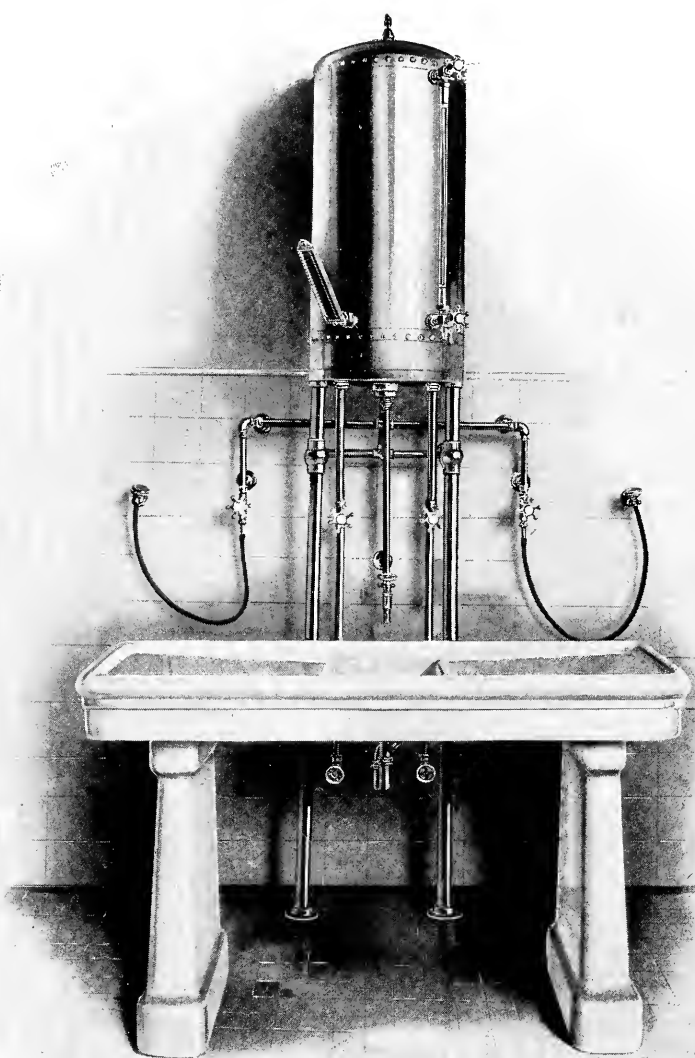


Figure 2—Infants' Bath



followed by apnea and rapid respiration. Even without direction the bather moves and rubs himself vigorously. The skin turns red and after a minute or two, before the red color changes into blue, the patient should leave the bath, should be wrapped up in a rough turkish towel and vigorously rubbed till he feels a glow, which means that the reaction is perfect. The heart beats stronger, the respiration is deepened and with it the patient has a sensation of strength and well-being. Every organ is stimulated, the appetite improved and constipation relieved. The bath is tonic and hardening. If the reaction is retarded, the cold plunge is best preceded by a warm bath and the towels used for rubbing and drying should be heated. The rubbing should be kept up until the reaction is perfect.

The disease of the heart and kidneys and of the lungs, inflammation of the abdominal organs and states of general weakness, contra-indicates the bath. A cold bath should never be taken after exercise and usually not after forty years of age. At that time of life the wear and tear commences to show on arteries and organs and the tax of such a bath does injury in course of time. In arteriosclerosis and heart disease, it may produce heart failure, or cerebral hemorrhage. Face, neck and chest should be washed with cold water before entering the tub, and the bath room should have a temperature of 70° F. It is useful in the young for hardening and toning purposes, as a prophylactic measure and as a treatment of people with relaxed tissues. It must be given with caution.

The cold bath is used to reduce temperature in febrile diseases and may be given with a number of modifications. The patient is taken from his bed and placed in a tub containing water of a temperature from 10° to 20° C. and he must be fully immersed in the water. Ice water is poured over his head, which act diminishes the disagreeable sensation produced by the cold bath, and he is rubbed by the attendant, then lifted into his bed, wrapped up in blankets, lightly dried and immediately dressed in his gown. Hot bottles may be applied to his feet. Ziemsson commences with a temperature of 35 ° C. little below the body temperature and gradually lowers it to 20° C. in duration from twenty minutes to half an hour.

THE HALF BATH

The half bath is an important measure in hydrotherapy, it lowers temperature without great shock, it stimulates and tones.

In the diseases of the chest, the chest organs may be especially treated and in the diseases of the abdominal organs, these may receive special attention. The patient is placed in a tub filled to a height of six to eight inches with tepid water, so that he is partly covered. The attendant then pours water of a temperature from 10° to 15° C. over him and rubs him, and when indicated encourages the patient to rub himself. The water poured over the chest deepens the respiration and if poured over the abdomen increases peristalsis and stimulates the abdominal circulation.

Another way is for the patient to sit in the tub or in an empty bath tub, the bottom of which has been covered with a sheet. Cold water is then poured over him. This is repeated every few minutes. Between times he is rubbed by the attendant. He is then put to bed, dried and covered, and hot bottles are applied to his feet. Or the patient may be placed on a cot protected by a rubber sheet, and treated with ablutions as outlined before, wrapped up in blankets, put to bed and surrounded by hot water bottles to induce perspiration. This measure is a powerful stimulant and of great value in sunstroke.

THE SITZ BATH OR HIP BATH

This bath causes congestions of the head and it is, therefore, necessary to protect the patient's head with cold compresses, or with bandages wrung out in cold water.

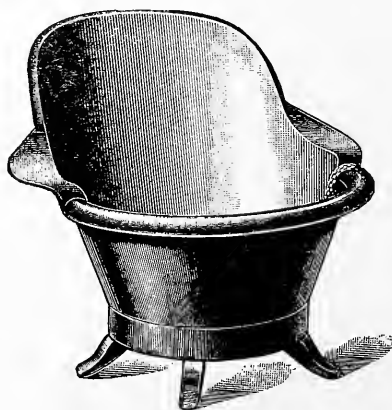


Figure 3—Special Tub for Sitz Bath

Tubs for the sitzbath are especially designed, to allow a comfortable position in the bath. The exposed portions of the body not immersed, are carefully wrapped up in woolen blankets. As

a rule it is not necessary to change the water, though in the prolonged sitz bath more may be added cautiously to keep the same temperature. The sitz bath acts especially upon the splanchnics—contracts them when given cold and dilates them, when given hot. A prolonged cold sitzbath causes continued dilation of the splanchnics. The short cold sitzbath acts as a tonic and is stimulating, but when prolonged acts as a sedative. The hot sitzbath stops pain, cramps and colics and relieves tenesmus of bladder and rectum. The cold sitzbath is used in all relaxed and atonic conditions of the abdominal organs.

THE FOOT BATH

The foot bath is an old time remedy, one of the most useful and popular measures in hydrotherapy. When given hot and prolonged before going to bed or better still in bed, it will frequently abort a cold, and the treatment of the acute infectious diseases is favorably commenced with a prolonged hot foot bath in bed. The head should be protected against congestion by an icebag or cold compresses. The bath is continued and hot water is added, if necessary, until the skin is red, warm and moist and covered with a light perspiration. Chilly sensations and restlessness pass, headache and fullness in the head are relieved and the patient feels more comfortable. After about half an hour the temperature sinks and a refreshing sleep follows. The foot bath may be repeated day after day as long as indicated. Mustard may be added to the water as an irritant—it makes the bath more effective.

The cold foot bath, like the hot foot bath, influences the circulation of the lower extremities directly and the general circulation by reflex. The foot is the most distant part from the heart and its circulation improved, improves the general circulation. Father Kneip directed his patients to walk around barefooted in the dewy grass and applied douches to the lower extremities, followed by friction.

This method may be given at home by filling the tub ankle deep with cold water and the patient walk up and down and splash around in the tub, followed by friction, if necessary, with heated towels, to produce a rapid and complete reaction. The cold foot bath frequently induces a healthy sleep and relieves burning sensations due to venous stasis. When the hot foot bath is given in bed, the bed has to be protected with a rubber

sheet or turkish towel and the foot tub should be covered with a blanket. If the patient sits outside the bed to take this bath, he has to be carefully wrapped up in blankets.

The hand and elbow bath may be administered in a similar way. In every case the temperature must be carefully measured to prevent burning.

SPONGING

Sponging is especially used in febrile diseases as a stimulant and prolonged to reduce temperature. It is also a useful measure to ascertain the capability of the patient to react, before subjecting him to the more severe measure of the cold bath and should precede this in every instance. If the patient does not react it is, according to Winternitz, a sign of threatening collapse. The sponging may be done with cold or tepid water, and especially when the latter is used to lower temperature, the portion of the body treated should be left moist to allow evaporation. Vinegar, sedative water, etc., may be added to suit the patient.

The attendant uncovers the arm, sponges it freely with sponge or towel dipped in cold or tepid water and dries with a rough towel. Legs, chest and back are treated in the same way, so that only the portion of the body treated is uncovered at a time. According to the purpose in view to increase tone, or to lower temperature and to relax, the temperature of the water has to be selected. The colder, the greater the toning effect and vice versa. It is a most useful measure and agreeable to almost anyone.

In fevers the face may be sponged with ice water and ice-bags applied to the head. It is always necessary to watch the feet and hot water bottles must be applied during the process if the lower extremities remain cold.

Instead the patient may be sponged with hot water and then rubbed with a towel wrung out in cold water. This is frequently agreeable for those who will not stand cold sponging and it has a similar effect, it stimulates and abstracts heat.

THE SHEET BATH

The patient coming from the bed thoroughly warm, has a towel dipped in ice water placed around his head to prevent congestion, and stands in a basin filled with warm water, to prevent chilling. The attendant behind the patient dips a large sheet in a pail of water from 12° to 18° C. and without wringing it out

rapidly places it around the patient, below the allae. He then fixes the sheet by pressing it with his arms against the patient's body and continues to wind it quickly around the shoulders, so that the patient is entirely enveloped in the dripping sheet. He then, using long upward and downward strokes, beats the patient with the palm of his hands, one in front and one in the back, to cause thorough reaction. The beating has to be rapid and elastic, similar to the tapotement of massage, so as not to cause pain and bruising. If the enveloping of the patient in the sheet is done quickly, it is more effective and less disagreeable. On closing



Figure 4—The Sheet Bath

this procedure the patient should be warm and the skin red, that is, reaction must be perfect and he should have an agreeable sensation, feel warm and refreshed. He is then rapidly dried with a rough towel, clothed and directed to exercise, or is wrapped up in blankets and placed in bed. The bath may be modified to suit the purpose. If the sheet is partly wrung out, it gives the sensation of a higher temperature. The temperature of the water may be lowered to increase the stimulating effect and vice versa, or water of any desired temperature may be poured over the patient during the procedure to increase stimulation.

If the patient reacts poorly, it is better and safer to precede the measure with a warm bath, a hot bath, or steam bath and not to give it at all if these measures are not sufficient to improve the condition. It is occasionally possible, however, to commence the treatment with water of a higher temperature and with each succeeding bath lower it as the patient becomes accustomed to it.

The sheet bath is stimulating and abstracts heat, though it finally has a sedative effect. Patients that do not react and cannot for other reasons be subjected to these vigorous measures, may be treated by rubbing to obtain similar effects. The alcohol rub and the salt rub are both daily used in private practice and sanitarium. A few ounces of alcohol, which may be used either diluted or pure is sufficient—and a handful of moistened salt, or a strong brine may serve the purpose. In both, the rubbing should be from periphery to center, as in massage, and the salt rub should be followed by an ablution or spray to remove the salt and clean the skin, and an anointment with oil may then follow.

THE BANDAGES

Bandages may be used as either cold or hot compresses uncovered, covered with flannel, or covered with flannel and oil-silk. For heat-abstracting purposes, the simple cold compress is used. A towel dipped in ice water, placed over an inflamed joint and frequently changed, will reduce the inflammation and if placed over the abdomen and changed every few minutes, is one of the best means to lower body temperature. The blood near the surface is cooled, returns to the center and the blood taking its place flows to the periphery again cooled. The Priesnitz bandage, a cold compress covered with flannel, acts as a stimulant to the circulation. The effect of the cold causes a reaction, and the bandage becomes warm, and gradually cools with the drying of the cloth. It is important, when applying this bandage, to cover it well with flannel so that no evaporation can take place at its borders. The bandage remains warm longer when oil silk is used. Hot compresses are applied to ease pain and reduce inflammation. They must be frequently changed or combined with thermophores to keep their temperature constant. Instead, the hot moist compress may be wrapped up in flannel before application and is then known as a steam compress. No matter in what form and at what temperature bandages are applied, they act by influencing the circulation, cause hyperemia and free

the inflamed structure from toxic substances. To prevent irritation of the skin it must be anointed with borated vaseline before applying the compress, and this should be freely applied to prevent blistering the skin when hot compresses are used. It is evident that a hot compress must be really hot to be useful and not too hot to do damage. Not rarely injury is inflicted by applying these bandages too hot. I have large scars on my body to bear witness to such injudicious treatment; on the other hand, these applications fail often to relieve, because they are not used hot enough.

Such bandages may be used to treat any portion of the body. A cold compress to the head will frequently relieve headache. The form of the bandage to be selected according to indications, congestions or anemia.

The Priesnitz bandage around the neck for inflammation of the throat has become a household remedy. To apply the bandage to the chest, shoulder straps are used to prevent it from slipping, or before winding the bandage around the chest, turns may be taken over the shoulders. Some clinicians use garments made specially for this purpose. For instance—Silberstein's vest, which is made of linen wrung out in water for the desired temperature and covered with a flannel jacket is much used. Instead of using a bandage around the legs, stockings may be wrung out in cold water and covered with a pair of dry woolen stockings—an excellent hypnotic. This measure is known as the hydriatic boot.

The bandage around the abdomen is known as Neptune's girdle and may be applied by winding its first portion around the body, wrung out in cold water, and using the balance as a covering. Instead, two bandages may be used—a bandage around the trunk, reaching from axillae to pubis, applied in the same way, and is especially used to abstract heat in febrile diseases. When employed for this purpose it has to be renewed from time to time until the temperature is reduced to the desired point. If employed for its stimulating effect it is left well covered for several hours until dry.

THE COLD PACK

The cold pack is applied as follows:

A woolen blanket covered with a wet sheet is placed under the patient by lifting him gently. He is then quickly wrapped up in the sheet, which is tucked between his legs and snugly placed

around his arms and the whole body is then covered with the blanket. An ice compress to the head and a hot water bag to the feet, prevent congesting and chilling. If two beds are at hand and the patient can be moved, it is more convenient to lift him from the second bed covered with blanket and sheet, or let him sit on a chair with his feet in a tub containing hot water, his head protected by a cold bandage or ice cap previous to the pack. Instead of the pack, the trunk bandage may be used. This abstracts less heat from the body, and does not effect the extremities, which slowly become warm. If the cold pack is used to lower temperature, it has to be repeated every five to fifteen minutes, followed by a cold rub. If used for stimulating and sedative purposes, it must be left several hours. It is important for this measure to wrap up the patient well in blankets to prevent air from escaping, not to leave him without an attendant, to see that the room is well ventilated, to wash his face with ice water, renew the ice cap or cold compress to the head as often as may be necessary, and not to commence the pack until the patient has emptied bladder and rectum. The pulse observed on the temporalis indicates the progress. It is first slowed gradually, returns to normal and just before perspiration sets in, becomes rapid. The measure may be interrupted if perspiration is not desired. A cold rub or ablution closes the proceeding. If used as an hypnotic the patient is at once placed in bed.

THE HOT PACK

The hot pack, like the cold pack, is applied with the sheet wrung out in hot water. The body temperature rises from 1° to 2° and perspiration commences after twenty to forty minutes—to be followed by cold ablutions or tub. It stimulates, changes the circulation and acts as a powerful sedative. In eclampsia, in the convulsions of childhood, and in uremic convulsions, it is a supreme remedy.



Figure 5—The Thermophore, Eiderdown Cover

A number of instruments for carrying temperature have been devised, of which the rubber bag is the most simple. It may be filled with crushed ice, ice water or hot water, to suit the purpose, and may be applied to any portion of the body, the head, chest, abdomen, back, feet and, if of oval form, to the neck.

Poultices of linseed, slippery elm, etc., are still frequently used. They keep the temperature better than hot, moist application and pigmentation and irritation of the skin may be prevented by anointing it freely with borated vaseline before using the poultice. A china plate heated in boiling water, wrapped in flannel and applied to the abdomen, serves the purpose well, and an ice poultice may be made by thickly covering a napkin with alternating layers of linseed flour and crushed ice and then folding the napkin. Such a poultice is easily adapted to any portion of the body, especially to neck and head, has a less chilling effect than the icebag, and it takes a considerable time for the ice to melt.

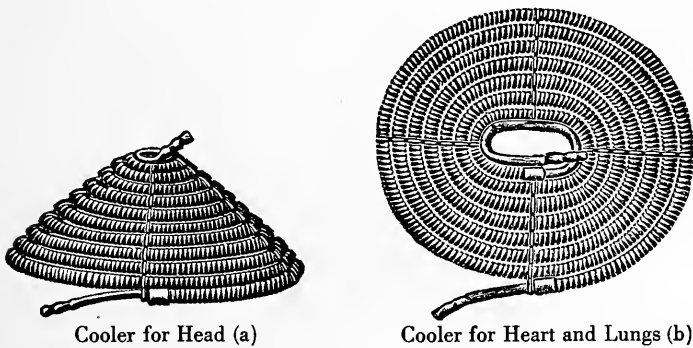


Figure 6

The coil consists either of rubber or of tin, the former is more convenient, and easier to apply. Water of any desired temperature may be used to pass through it. Its great advantage is, that it may be used for any length of time at a constant temperature, to cool, or irrigate the mouth, rectum or vagina, or to cool any portion of the body. Colonic flushing is used to clean the colon and to lower temperature. For the latter purpose a normal salt solution passed into the colon through a soft nelaton rectal tube provided with return flow, is best employed. The tube should not be introduced more than four or five inches. It will coil up in the rectum when the attempt is made to introduce it higher, and it is an illusion to think that by doing this, it will

reach higher portions of the intestine. High enemas are important for diagnostic purposes in acute and chronic obstructions of the bowels. If this measure has been used in an acute condition without giving relief, no time should be lost and an operation should be performed at once. In chronic obstructions, time is not such an important factor, and repeated attempts may be made to relieve the obstruction by enemata. This measure will frequently succeed. As a rule the liquid reaches the coecum and even the lower portion of the ileum.

The procedure is as follows:

The patient lies on his back, hips slightly elevated, a soft Nelaton rectal tube with two wide openings in its sides, is then well lubricated with vaseline and introduced. The tube is connected with a small piece of glass-tubing, a "window", and this attached to a soft rubber tube three to five feet in length, which connects with a glass funnel of a quart capacity. The funnel is filled with half a quart of water of body temperature and by raising and lowering it, the water entering and returning from the colon frees it from air. An attendant holds the rectal tube near the anus to prevent it from slipping out, and moves it lightly forward and backward, if the openings have been stopped up by fecal matter. After this preparation, the funnel is filled and the water is allowed to flow into the rectum under a pressure of not over three feet. That is, the water level must not be higher than this above the anus, though occasionally it may be increased to remove fecal particles that might stop up the tube. As soon as half a quart has passed into the intestines, the funnel is lowered and the water allowed to run out, the funnel is then raised again and another half a quart allowed to enter. This proceeding is repeated until the water has reached the coecum, when it is stopped. The slow progress of this technic softens the fecal matter, accustoms the intestines to the unusual pressure and removes air that may be in the colon. As a rule three to four quarts of water may be injected in this manner without trouble.

This method though slow, is to be preferred for diagnostic purposes. The quantity of water in the intestines as well as the pressure under which it stands is known during the whole process. Distension of the colon with air, however, may be necessary when percussion has to differentiate area by their dullness from tympany; this is more dangerous. For purgative purposes, castor oil or glycerine are first poured into the funnel and allowed to enter the rectum, driven high up into the colon by the water with which the funnel is then filled, raised to the usual height.

This is Naunyn's technic described by Kausch who has invented a rectal tube with balloon attachment, for patients with weak sphincter, or those that do not care to hold the water, such as hysterics, and who will frequently on that account make the administration of copious injections impossible.

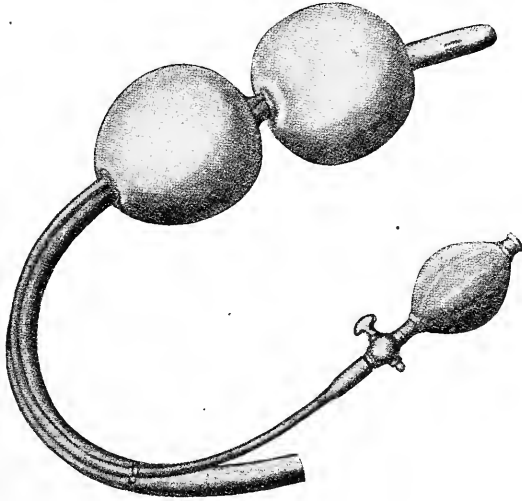


Figure 7—Rectal Tube, with Bulb Attachment, After Kausch

Two rubber bulbs, separated from each other by a distance of from one to two C. M. and six C. M. from the end of the tube, are attached to a nelaton rectal tube. Each bulb, when inflated, has a diameter of eight C. M. and of nine C. M., when distended to its limits. The bulbs are connected with a thin rubber tube closely attached to the nelaton to allow their inflation. After the insertion of the tube and of the first bulb, they are both inflated and grasping the sphincter in the middle, close the opening tightly. The bulbs are given the form of an orange to accomplish this better, are not pointed, as is usually the case with air bulbs. Kausch believes that he has saved by his method a number of patients from serious operations. It is better to have a separate air supply pipe for each bulb. Air will pass, when both communicate, from the inner bulb to the outer, on account of the higher pressure to which this is exposed and becoming smaller may slip out.

PROCTOCLYSIS known as MURPHY DRIP in this country and KATZENSTEIN'S continuous rectal infusion, or TROEPFCHEN EINLAUF in GERMANY.

The method is based upon the capacity of the rectum to absorb water or physiologic salt solution in large quantities, and continuously, for days. The liquid when flowing into the rectum at body temperature must be kept under low pressure and it is best to allow drop by drop to be absorbed. The saline infusion has in the course of years become of such an importance and the indications for its use are so many, that it is now almost daily resorted to in medical and surgical practice. It raises blood pressure, washes the tissues, frees them from toxins, dilutes the urine and increases diuresis, purifies the blood and improves circulation. There can be no doubt that in a very large number of cases the rectal infusion can take the place of the subcutaneous and intravenous method. If the filling of the vessels has to be prompt and rapid, as for instance, after a severe hemorrhage, in collapse and in a sudden lowering of blood pressure due to vaso-motor paralysis in the course of a peritonitis, the intravenous and the subcutaneous methods have to be used. In all other cases, in the acute and chronic infectious diseases, in wasting diseases, in small and continuous hemorrhages, etc., the rectal infusion is to be preferred.

The method is simple and can be used by the nurse without causing any inconvenience to the patient. Sterilization and antiseptics are unnecessary and the danger to overfill the vessels by injecting too much liquid, as present in the former methods, is entirely removed. The absorption of the quantity is left to the organism and too much of it, especially of Sodium Chloride, is rejected by the system. According to the observations of Sippel, diluted saline solutions or pure water is again absorbed after normal salt solution has been expelled. Another and most important advantage is that the organism can draw from an inexhaustible supply. The rise of blood pressure is more efficient and prolonged, than in either subcutaneous or intravenous injections. A number of instruments have been devised for the purpose of administering infusion. One of the best and most simple is that described by Dr. Martin of Cologne.

The container, filled with the normal salt solution, is fastened to the foot end of the bed, so that the water level is from forty to fifty C. M. above the anal orifice. The flow coming from the irrigator is regulated with a clampscrew and is connected with

a small glass bulb. The bulb has two glass tubes leading to and from it. The former passes with a slight curving into the bulb and the lower one is connected with a soft rubber tube several

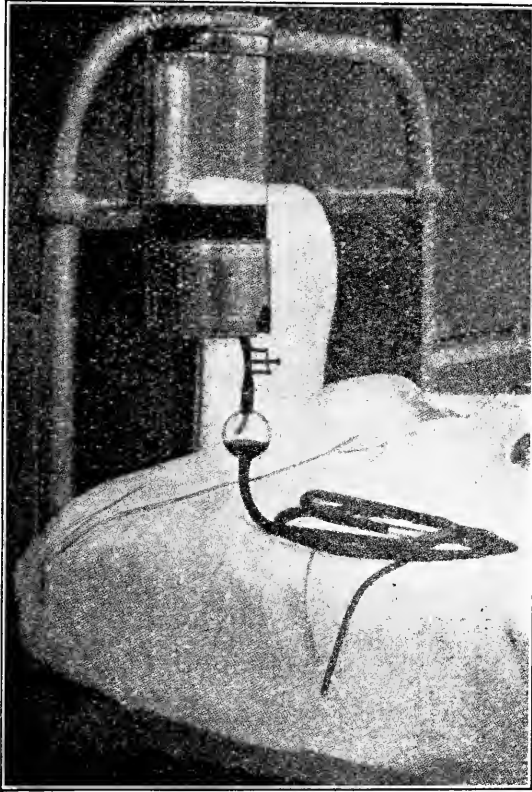


Figure 8

yards in length, through another small piece of glass-tubing—"a window"—with a Nelaton catheter, not large enough to excite rectal contraction. The liquid is then allowed to flow by opening the clampscrew, and is so regulated that each drop can be readily observed at the drop glass. The rectal tube is then well greased and inserted into the rectum. The bulb fills with liquid and closes up the tube, if the drops flow too fast, and becomes empty if the flow is too slow. A small amount of liquid fills the

lower portion of the bulb constantly, if the flow is correctly regulated. Any alteration can be readily noticed and corrected by regulating the clampscrew. It is unnecessary to keep the water

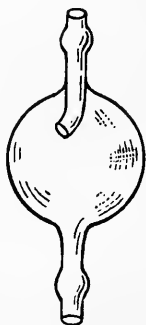


Figure 9

in the container at a certain temperature, as each drop entering the rectum takes up rapidly the body temperature. The bowels have to be emptied before using the infusion.

The average amount of water to be injected is from one and a half to two quarts per day, though more or less may be introduced, as indicated by the state of the patient and the disease. If a heating of the solution is desired, a metal tube may be connected with the rubber tubes, wrapped up in an electric heater or a thermos bottle may be used as a container.

The lavage of the stomach, the vaginal douche, the irrigation of the bladder and rectum, are popular hydrotherapeutic measures daily prescribed and well understood. Aside from the direct cleansing effect and removing danger thereby of infection and contamination of the blood, they act upon the circulation, improve it, and are used to soothe pain in all inflammatory conditions of these organs, and also to free them from toxic substances. The instruments devised for the application of heat and cold in the mouth of the vagina and rectum for the same purpose, consist of a glass bulb adapted to the cavity used, provided with a return flow to allow the water of any desired temperature, cold or hot, to enter and to return and to keep the instrument continuously at the same temperature. These devices may be inspected in the shops of any instrument maker.

THE ABLUTIONS

Ablutions are usually given cold after a warm bath. It is a very mild measure, but extremely valuable. It is useful to improve the sick and harden the healthy. It may be applied to the whole body or over a portion of it. The water may be poured from a watering can, or from a pail or pitcher, or a sponge dipped in cold water may be pressed out over the chest and spine and every other portion of the body, or the patient may be rubbed by the nurse with a mit,—



Figure 10

—“wet mit friction”. All these procedures have to be followed by drying with a rough towel until the reaction is perfect, and it is frequently best, especially when the patient is easily chilled, to make the cold application, while the patient is standing in a tub filled with warm water, to prevent chilling. The warm bath relaxes and draws the blood into the periphery, the cold application returns it to the center, and friction causes the reaction. This effect upon the circulation stimulates the function of every organ and the ablution or sponge bath, when properly applied, especially its effect, is enjoyed by everybody.

Temperature, pressure of the falling water and method of application, can be varied to suit any case. The ablution should never last more than a few minutes.

THE DOUCHES

The treatment with douches, on account of the complicated apparatus, must be usually left to institutions, though a good deal can be accomplished in a modern bathroom.

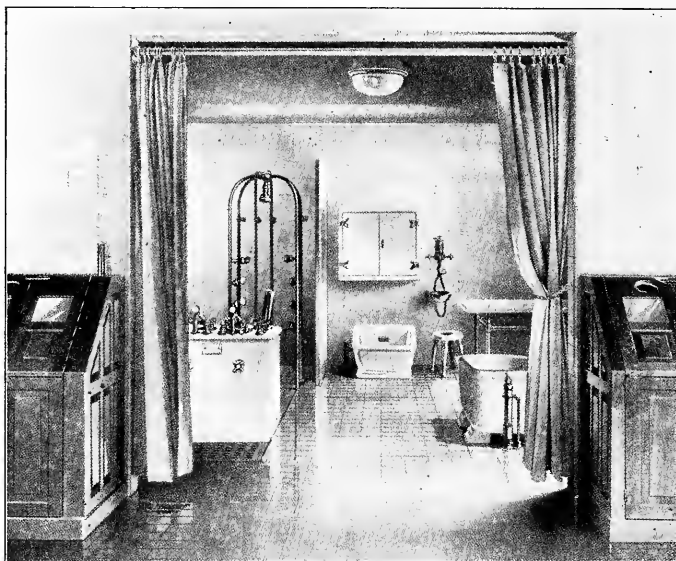
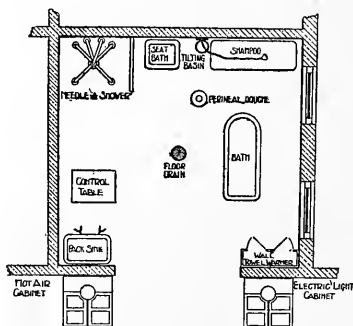


Figure 11—The above interior illustrates a complete equipment for Douche Room.



The effect of a douche depends on pressure and temperature, the former ranging from ten to thirty pounds and more to

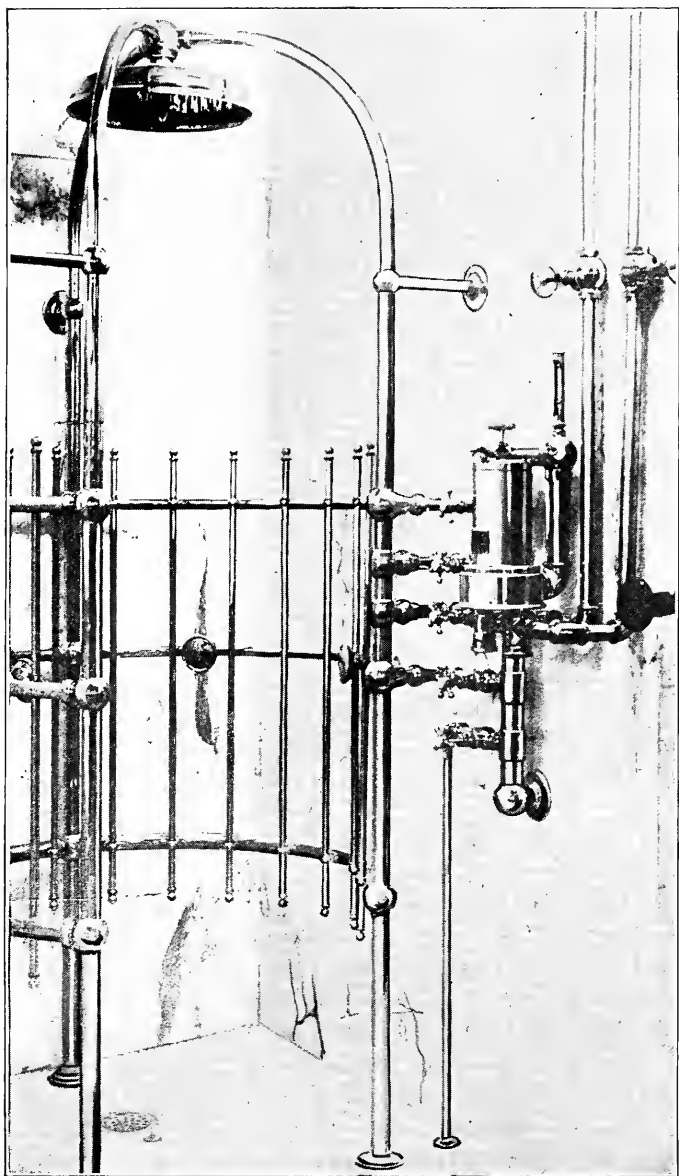


Figure 13- Leonard Valve Model, controlling combination needle, spray and descending shower, with removable and adjustable rose sprays, pressure gauge, etc.

the square inch. It is administered cold or hot. An easy and rapid regulation of temperature and pressure is an absolute necessity and is usually done from a control table.

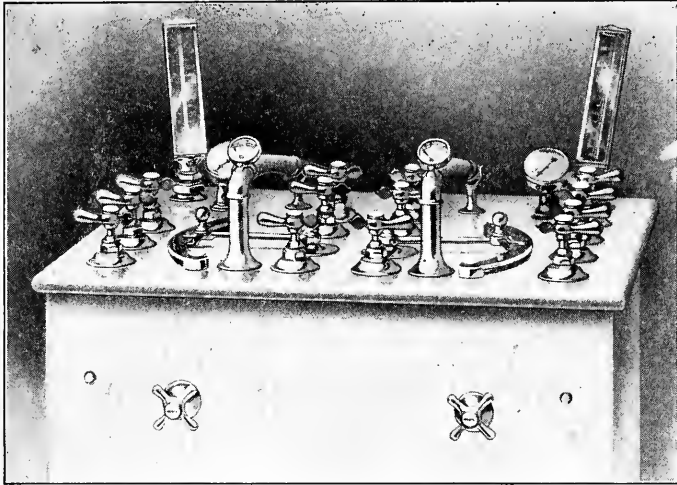


Figure 12—Control Table

The rain douche or shower bath, a very popular bath, is found in every public institution, and attachments to give it, may be easily adjusted to the bathtub. The spray may be fine or coarse, the pressure light or heavy and the temperature as desired to suit indications. Blood and lymph circulation can be powerfully influenced by this measure and it may be used cold for its stimulating or warm for its sedative effect. It may be used alone or in combination with the warm bath or turkish bath. The attachment is fixed under an angle, so that the spray does not strike the head. (Figures 13 and 14).

In jet douche or filiform douche, the opening of the nozzle is very fine. Both forms are employed with great pressure for their stimulating effect and the latter may be used occasionally with advantage in sciatica and neuralgias affecting other nerves. The jet douche consists of a single stream of water coming from a nozzle. A hose attachment will do for treatment in the patient's house. This douche, when administered cold acts as a powerful stimulant and is especially useful in the treatment of separate portions of the body. Like all cold applications it should be fol-

lowed by vigorous friction with a rough towel. The fan douche, a modification of the jet douche, may be improvised by placing the thumb to the nozzle, so as to spread the stream fanlike. Instead, a nozzle attachment for this purpose may be employed.

A modification of the rain bath, and usually combined with it, is the needlebath. This consists of rain douches arranged in circles, one above the other, at a distance of a few inches. The perforations of the tubes are small and the jets fine, giving one the impression when exposed to it of numberless needle pricks. Movable and fixed douches and ascending and descending douches are used.

A hot douche, more prolonged, followed by a short cold douche, is known as the Scotch douche, though others understand by this term, hot and cold douches alternating. Douches should not be given to the head, so as to avoid shock. When given to the front of the chest, they have to be given with caution.

A very beneficial douche is the steam douche. The steam has to be cooled down to a temperature of 40° C., that is, a thermometer held in the steam jet, must not rise above that temperature. This form may be used just like the water douches, and the effect it produces is practically the same.

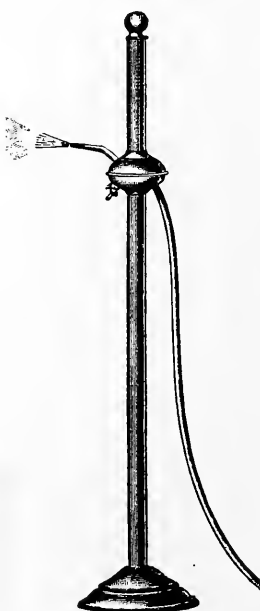


Figure 15—The Steam Douche

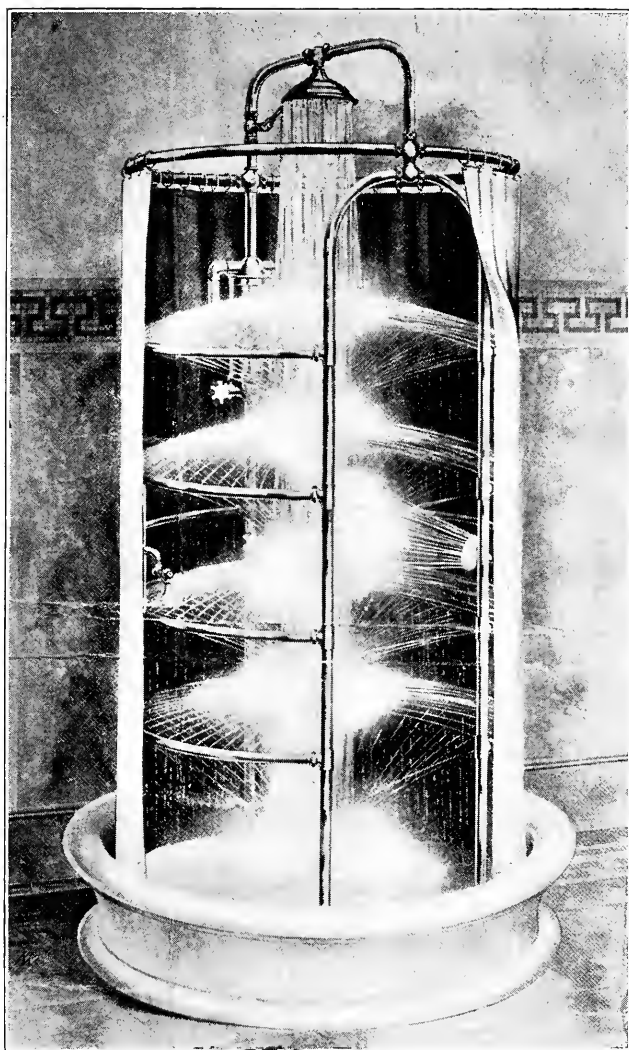


Figure 14

The treatment with douches is usually combined with the bath. The same rules apply to cold douches as to cold ablutions, and they may be used instead. A douche of short duration is followed by vigorous friction to produce reaction. All affect blood and lymph circulation, act in a stimulating manner, or like a sedative, and when given cold, cause prolonged rise of blood pressure. They are an important measure in hydrotherapy to improve the general circulation of the whole body or of certain organs and to help purify the blood.

THE WARM BATH

A warm bathroom, temperature from 70° to 80° F. and a tub of warm water is all that is needed for the warm bath. The functions of heart and lungs are not disturbed and the body temperature is not affected by this procedure. The bath has been appropriately termed indifferent. It may be given, and it is usually given, from twenty minutes to half an hour, though it can be prolonged for days and months. The patient is permitted to select the temperature in which he feels comfortable, when directed to take a tepid bath. A temperature of 100° F. is usually found suitable. The water cools down slowly and keeps its temperature for quite a while, so that arrangements to keep the water warm is not necessary, except when the bath is to be continuous. It may be given for cleansing purposes, or to precede the cold plunge or cold douche, and is an excellent hypnotic when taken before going to bed. When used for this purpose, the patient should not be rubbed, but lightly dried after the bath, or even better, simply wrapped up in blankets and put to bed. A prolonged bath dilates the arteries and draws the blood into the skin, relieving abdominal congestion, eases heartwork and influences favorably arterio sclerosis and Bright's disease.

When administering this bath in febrile disease, the patient should be rubbed while in the bath. This lowers body temperature and is more agreeable and attended with less shock, but is not as effective as the cold bath. A sheet or hammock fixed in the bath tub for the patient to rest upon, and a supply pipe, with an outlet, in the bottom of the tub to allow the water to run out, is sufficient for the continuous bath. (Figure 16).

This bath, frequently used in the treatment of nervous and mental diseases, and in the diseases of the skin, may be used with advantage in many other conditions. It requires constant atten-

tion and for that reason, it will not be uniformly used, whenever it can be dispensed with.

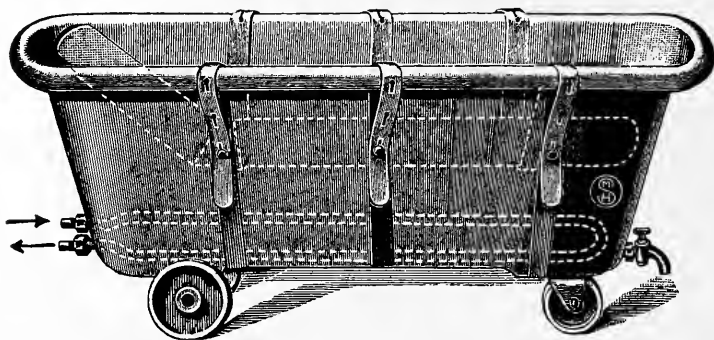


Figure 17—Movable Bathtub for Continuous Bath, with adjustable straps to hold mattress.

THE HOT BATH

The hot bath stimulates and excites and causes perspiration. Japan is the country of the hot bath, everybody takes it for its stimulating effect. Horndale states that in Tokio alone over 400,000 hot baths are given daily.

During hot days, a bath in hot water taken in the hours of greatest atmospheric heat, tends to reduce the heat of the body and preserves its normal temperature during the day (Louis Smith). In tropical countries and in very hot seasons no means of cooling is more lasting than a bath or douche of hot water. (Wunderlich).

The bath room should be large and well ventilated, the temperature of the bath 40° to 42° C. and above. Some people are very sensitive to heat and in these cases it is best to commence with a lower temperature and increase it gradually by adding hot water to the bath. Congestion of the head and neck have to be prevented by bathing both with hot or cold water before entering the tub. Respiration and heart action have to be carefully watched and it is best to cover the tub with a rubber sheet to prevent the rising steam from inconveniencing the patient. The bath may be followed by hot or cold ablutions and the number of baths given daily and their duration has to be prescribed according to indications. If the stimulating effect alone is desired a few minutes are sufficient, and if the sweat producing action is desired, from fifteen to twenty-five minutes

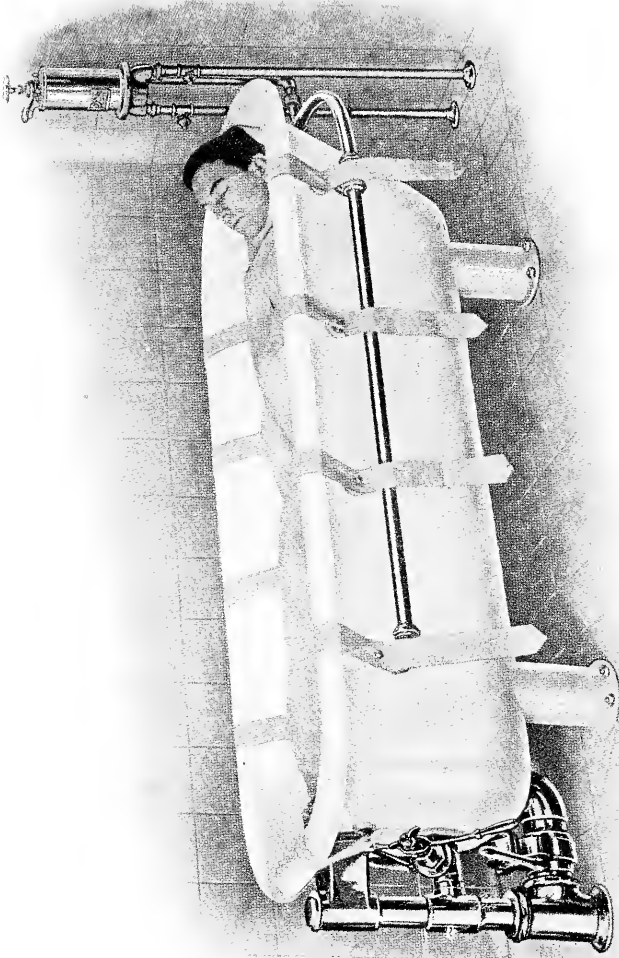


Figure 16—Continuous Tub, equipped with valve control, canvas hammock and retaining cloth as used in hydrotherapeutic treatment.

are necessary. It is not difficult to give such a bath in the larger cities, where well equipped hydrotherapeutic institutions are connected with hospitals, and even in the better arranged houses where the bathtub is connected with an instantaneous heater, such a bath may be had at any time. It is of greater trouble when the water has to be heated in the kitchen and carried to the bathtub. Yet, in some cases this bath is almost indispensable and should be ordered in spite of the trouble it may cause to prepare it.

THE MEDICATED BATH

Various additions may be made to the water to increase its effect or to decrease it, that is, either to increase or decrease the effect of temperature upon the skin. The saline bath is prepared by adding from one to five per cent. of sea salt, vichy salt or epsom salt to the water. The mustard bath is made by adding from one hundred to five hundred drams of finely ground mustard meal to the bath. The mustard meal is stirred with a little water to a thick mush upon a piece of cloth, which is then wrapped up and pressed out in the bath. The hot mustard footbath and handbath are popular measures and are in daily use.

Heubner treats capillary bronchitis of children by dipping a linen sheet in three pints of water thoroughly mixed with one pound of mustard. The sheet is then wrapped around the child, who is covered to the neck with a woolen blanket. As soon as the child complains of discomfort, after about ten to fifteen minutes, the covering is removed and the mustard washed off in a warm bath. A warm wet pack follows in which the child is left from one to two hours. The pack is then removed and followed by a warm bath gradually cooled. The patient is dried and allowed to rest. This is repeated every day. The application of the mustard sheet causes a thorough reddening of the skin, the mustard fumes are not inhaled and the wet pack causes free perspiration. The treatment is effective.

THE PINE NEEDLE BATH

Extract of pine needle, in which the Oil Pin. Sylvestr. is the active principle, is added to the water. The amount necessary to medicate the bath is stated on the packages sold. Preparations vary in strength—The MUDBATHS, usually administered at watering places, are used as full baths, packs, or poultices and are especially useful in rheumatism and gout. In private practice

they may be prepared by adding two pounds of the preparations to the bath. These preparations are easily soluble, however, and the bath acts as a saline bath, whereas, the mud and peat baths as given in the watering places, act by an additional mechanical irritation of the skin. The bath may be given prolonged and of high temperature on account of the poor heat conducting quality of the mud.

THE SULPHUR BATH

Twenty to thirty grs. Kal. Sulphuratum may be added to the bath known as Sulphur Bath, tannin or corrosive sublimate may be used. An addition of herbs to the bath is very popular with the laity, and camomile, mint, orange flower, sage, etc., are frequently used. The aromatic odor is agreeable and suggestive. Decoctions of almond meal and of salt may be added to the bath to lessen its irritating influence on the skin, or four to six pounds of malt, boiled with four to eight quarts of water, pressed through a sieve, may be added to the bath for this purpose.

THE CARBONDIOXIDE BATH

(Figure 18)

This bath may be prepared at home and is now freely used in private practice. A number of American and European manufacturers have placed the artificially prepared ingredients for the bath on the market. One of the oldest is Sandow's preparation. Four little packages of Sodium Bicarbonate and four cakes of Kalium Bisulfate in a proportion of 100:240 are added. The cakes of Kal. Bisulfate should be well distributed in the bathtub, best upon a rubber sheet, covering the bottom of the tub, or upon saucers to prevent injury to the tub. The patient then enters the bath and the sodium bicarbonate is distributed in the tub. The imported Nauheim Salt, consisting principally of Sodium Chloride and Calcium Chloride may be added to the bath to increase its stimulating effects. These salts may be bought with the preparation. It is important that the Carbondioxide surrounds the patient with fine gas pearls that adhere to the skin. Only when that is the case, is the bath effective. The treatment is generally commenced with a temperature of 90° F. and a duration of from seven to ten minutes. As the patient improves, the temperature is lowered and the time prolonged. The same course is generally pursued with the composition of the bath. A smaller quantity is first used to prepare it, and this is gradually increased in the course of the treatment. The patient has an agreeable prickling sensation when in the bath, is less sensitive to lower

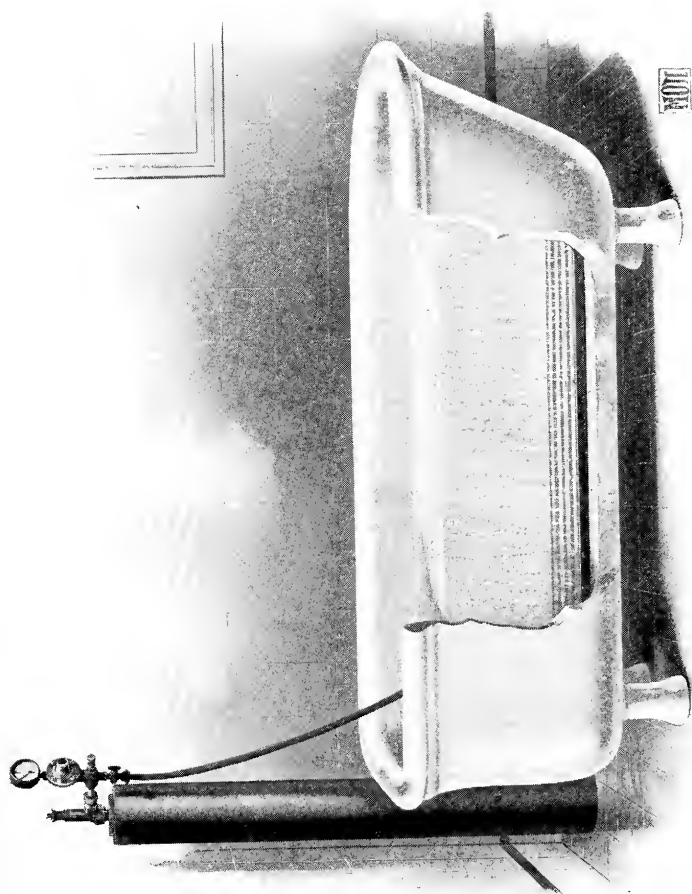


Figure 18—The Carbon dioxide Bath.

temperatures and reacts promptly, the skin reddens after a few minutes of exposure. The room must be well ventilated to permit the Carbondioxide gas to escape and the bath tub should be covered with a rubber sheet to protect the patient from the gas.

Dr. Zucker's carbonated bath, manufactured by Max Elb of Dresden, Germany, a solution of Formic Acid, eighty per cent. is poured into the bath and thoroughly mixed with the water. The patient then enters and applies gently gauze bags filled with Sodium Bicarbonate to the various portions of his body. This is a very efficient and easy way to administer it.

Cassebeers Salts, prepared in this country, act well.

The Oxygen Bath recently introduced in hydrotherapy has become a valuable addition. The ingredients to prepare the bath are sold in the market in two separate packages, enough for each bath, with printed directions. The bath is given at a little below body temperature from fifteen to twenty minutes in duration. A course of treatment consists of twenty to thirty baths given on five consecutive days, with a few days of intermission and so on, or one bath every other day. Just as in the Carbondioxide bath, the patient must be covered with fine gaspearls if the bath shall be effective. The bather has an agreeable sensation of warmth, though the skin looks anemic, the blood is driven into the muscles. The bath lowers blood pressure, slows the pulse and deepens respiration, it has a soothing, calmative and indirectly stimulating effect. On account of this property it is especially indicated in the functional neurosis, though it has no contra-indications except a low blood pressure.

THE WATERS OF MINERAL SPRINGS

Most of the waters of the springs that have established reputations, are radio-active. A bath of 98.5 F. will cause rise of temperature of the patient in the bath, followed by profuse perspiration, drop of temperature to the normal, and a considerable fall of blood pressure, provided that the water is sufficiently radio-active.

HYDROTHERAPEUTIC MEASURES TO PRODUCE PERSPIRATION

One of the most important of all, for private practice, is the hot air and vapor bath in bed. The patient lies on a woolen blanket, with a frame placed over him and several blankets to

cover this as nearly airtight as possible. The ends of the blankets must be well tucked, especially around the neck and feet to produce an airtight compartment, as it were. The elbow of a small stove-pipe is then so placed, that one end wrapped up in wet towels or surrounded by asbestos, passes into the improvised air chamber and under the other opening, outside the bed, a small alcohol lamp or Bunsen burner heats the air. Perspiration commences usually after a few minutes and the patient may be allowed to remain from half an hour to an hour, as indicated. The head has to be wrapped up in towels dipped in ice water to prevent congestion and the patient may drink cool water freely during the sweat bath. In certain cases it is advisable to apply a dry pack (woolen blanket) to the patient, before improvising the hot air compartment and to remove the frame as soon as he perspires freely and continue the perspiration in the pack. Steam may be used instead of hot air, by placing boiling water below the free-end of the stovepipe elbow in a small kettle. The water used must be replaced by boiling water, so as not to interrupt the process.

AIR AND VAPOR BATH

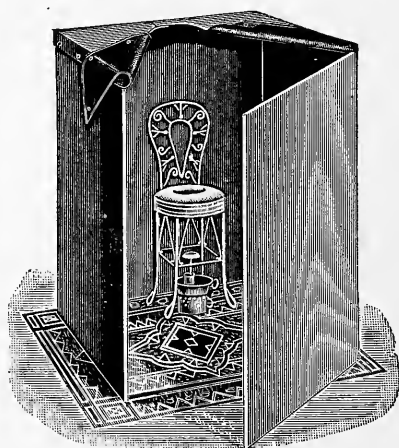


Figure 19 and 20

"THE CABINET"

The air and vapor bath has become very popular and may be used when the patient is able to sit up.

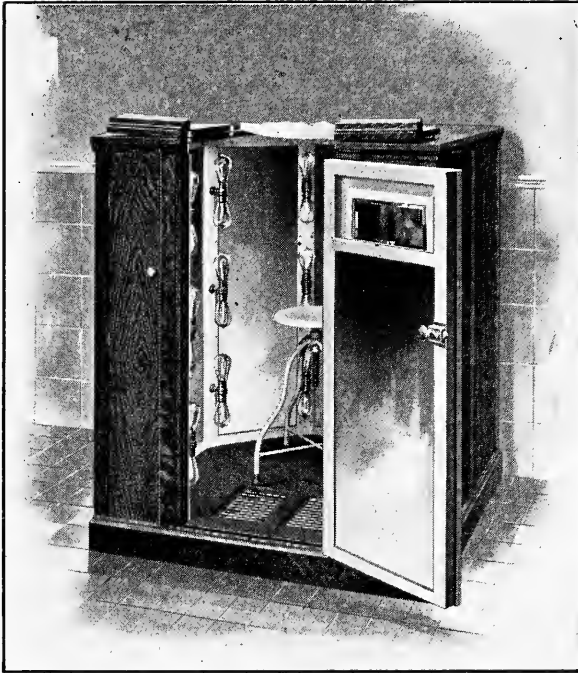


Figure 21—The Electric Light Bath Cabinet

The electric light bath cabinet is superior to either in cleanliness and though its indication is its sweat producing power, the penetrating power of light rays is a factor to be considered in its employment. These various methods to produce perspiration are all superior to the Turkish and Russian bath. They can be used at home, even if the patient is confined to his room or bed, and the air he breathes is pure and fresh and free from the exhalations and excretions of others.

Perspiration may be increased by directing the patient to take a cup of hot tea or milk previous to the bath. During the bath, however, cool drinks should be given, limited in quantity, when loss of weight is the object of the treatment. Congestions of the head must be guarded against. Cold applications in the form of ablutions and douches should follow the sweat bath, as a part of the treatment, and to prevent irregular and uncontrollable cooling of the body, that is, to prevent colds. A very good method to produce perspiration and as a rule well-liked by the patient is the sand bath.

The temperature of the sand ranges from forty-five to fifty degrees C., though it may be very cautiously and gradually increased. The temperature is regulated by carefully mixing hot and cold sand and every layer of it has to be tested with the

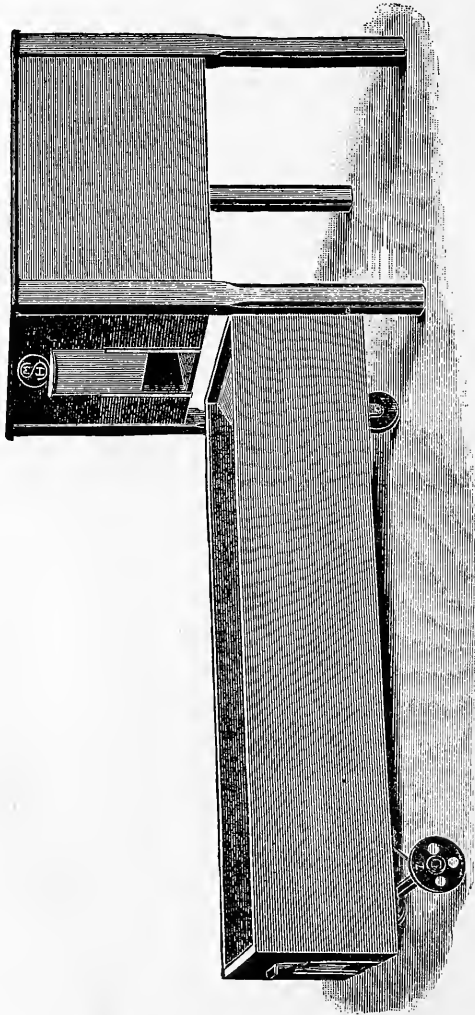


Figure 22.—Sand Bath and Sand Heating Apparatus

thermometer, to prevent burning of the patient. The bath is generally administered in a flat wooden tub on rollers, so that when covered with woolen blankets the patient may take his sweat bath in the open air, which makes it all the more pleasant.

Congestions of the head, have to be prevented by cold towels, or the ice cap, and by sponging the face with ice water. A cool tub bath, ablutions and douches follow the bath.

All methods to produce perspiration cause rise of body temperature, least of all the sand bath, generally not more than 0.5° C.

Instead of these general procedures, the same methods may be used to produce local sweating. A number of appliances have been constructed to serve the purpose. Local electric light and air baths are daily used by the general practitioner and their action, to produce an active hyperemia is well understood. The effect of all general and local applications is their influence upon blood and lymph composition and distribution. If general measures are employed upon the whole system, every organ is affected by it; and if locally given, certain parts of the body only, though a slight effect upon the whole organism cannot be entirely excluded.

HYDROTHERAPY IN DISEASE

INFECTIOUS FEVERS

Fever patients regulate temperature just like the healthy, though during a course of fever this regulation is not as perfect as it is in health. The proper proportion between heat production and heat loss is changed, less heat is given off and heat production and body temperature is increased. The peripheral vessels of such patients do not contract as energetically as in health after a cold application and their dilation is prolonged after a cold bath, due to atony. During the bath, the blood is cooled at the periphery, returns to the center and friction draws another supply to the periphery to be cooled and to return. Such a bath is, therefore, a supreme remedy to reduce temperature. The circulation seriously affected, due to vasomotor paresis, is improved by the cold bath. Peripheral vessels contract and the blood is driven through the anemic organs, deepening the respiration, slowing and strengthening the pulse, increasing the diuresis, washing and freeing the tissues from toxic substances and eliminating them through lungs, kidneys and skin. Peristalsis is increased and waste matter removed from the bowels; cyanosis disappears, the tongue becomes clean and moist, a soporous condition clears and appetite improves; metabolism is

increased, and toxins, according to Libermeister, are burnt up, and the improved circulation makes the soil unsuitable for the pathogenic micro-organisms to grow. The composition of the blood is changed and at least, temporarily, the number of cellular elements increased. The application of the cool or cold bath, with friction, answers all indications—temperature and duration to be suited to the condition of the patient. It is necessary to ascertain his capacity to react, and to commence with higher temperatures and gradually cool down, until his sensibility to these measures is known. Unnecessary movements of the patient must be avoided, and a fever patient should never be allowed to enter the bath by himself. Some stimulation may be given, in forms of wine or whiskey before the bath, to facilitate the reaction.

After the bath, the patient is placed on a sheet, lightly, or not at all dried, so that a film of water remains for evaporation to reduce temperature, and hot water bottles should be placed to his feet, if he shivers. Every thing must be in readiness, not to excite the patient, when giving the bath. Many like the bath and react well. Some react poorly and shiver. It is especially necessary in these cases to begin at a higher temperature and prolong the bath, from fifteen to twenty minutes duration is usually sufficient. In others the carbondioxide bath may be tried, which gives good results in such cases and may be discontinued, after the patient has become accustomed to the bath. Patients with seriously damaged hearts and vessels; patients that do not react after the bath, and patients that show symptoms of collapse, or sudden drop of temperature below the normal, fluttering pulse and cold extremities, should not be treated by this method.

TYPHOID FEVER

In typhoid fever, the temperature and duration of the bath should be selected according to the state of the patient. Only with the strong and vigorous should the Brand method be used. The bath should be given whenever the temperature rises to $102\frac{1}{2}^{\circ}$ F. in the rectum, duration of bath fifteen minutes, temperature from 16° to 20° C. It is claimed that this method reduces the mortality to five and six per cent.

Most clinicians prefer to give the bath at a temperature of 70° F. and above from five to fifteen or twenty minutes duration. Friction is necessary in all cases. No fixed rules can be given to regulate the number of baths. Brand's rule—to repeat when-

ever the temperature reaches 102.5 F.—is a good routine, to be changed when indicated. A small frequent and dicrotic pulse, a severe infection and a beginning broncho-pneumonia, call for the bath at a lower temperature. A frequent repetition of the bath is not necessary when the general condition of the patient is good, notwithstanding a high temperature. The purpose of the bath is to purify the blood, improve the circulation and only secondarily to reduce temperature. The patient must not be too frequently disturbed. Rest is an important factor in the treatment of disease and patients should be as little as possible disturbed at night when there is already a remission, unless a hyperpyrexia, a dicrotic pulse, or a soporous condition indicate the bath. Such a condition is rare, when this treatment is followed.

The method should be used in every case of typhoid fever, even in apparently lightest cases, as these may suddenly change into severe forms, and there is not a better method than this to lower temperature and to improve the composition of the blood and its circulation. The consequence is that the function of every organ is improved and the continuous high temperature curve is broken. In cases of threatening collapse hemorrhages, or of perforation and of all other conditions that require absolute rest, this treatment is contra-indicated. The very young and the very old react poorly, and higher temperatures of the water should be used with these patients.

I have used for many years a prolonged tepid bath in cases of this disease, with excellent results. The water, administered at a temperature of 90° to 98° F. The patient is kept in the bath from fifteen to twenty minutes, and thoroughly rubbed while in the bath. It is claimed by some, that such a bath does not give the tone as well as the cool and cold bath will. I have found it sufficient for this purpose. The temperature falls, within half an hour after the bath, one—two and even three degrees F. It has a toning and calming effect. The face of the patient becomes bright, the nervous symptoms less and gastric symptoms never last more than a few days after the bath has been commenced. The appetite improves, the tongue becomes moist and the urine light in color and increased in quantity. This bath gives strength to the heart, volume to the pulse and causes a washing of the tissues, freeing them from toxic substances and waste, eliminating them through the natural channels, just like the cold bath. This bath is never objected to by the patient.

The bath may be given in bed. A woollen blanket, covered with a linen sheet, and rubber sheet above this, is pushed below the patient, so that he lies in its center. A pillow below the rubber sheet is placed under his head. A light frame, such as any carpenter can make in a few hours, then placed over him and the rubber sheet with rings is tied to the frame. The bath tub is then ready to be filled with water of the desired temperature. After the bath a large corner of the rubber sheet is turned down and the water allowed to flow into a common washtub. The balance is rapidly taken up with a large sponge. The bath can be emptied in one minute and improvised anywhere in a few hours. It is given without disturbing the patient and with but little trouble to the nurse. After the bath is finished, all that is necessary, is to remove the frame, pull the rubber sheet from under the patient and wrap him lightly in sheet and blanket, with hot bottles to his feet, if necessary. Even at the height of the fever, usually during the second week, usually not more than three to four baths are necessary and these only during the day. If it becomes necessary to reduce temperature between baths, sponging may be resorted to. Its effect, however, is inferior to the bath.

The cold pack to the trunk or to the whole body may be used if the tub bath cannot be given and high enema of cold water may be occasionally given to reduce temperature, if there is no danger from hemorrhage. However, it must be constantly borne in mind that the main object of the bath and its substitutes is usually not reduction of temperature, but the purification of the blood and improvement of the circulation. There is no cause to interfere with the temperature in infectious diseases, except in cases of hyperpyrexia. In fact, such an interference may do harm. Increase of temperature in infectious disease is a curative factor and is centrally regulated, as is shown by the rapid rise to the original point after an antipyretic has been administered and the effect has worn off. The physician has to judge when to assist and when to curb nature in her efforts to cure.

MEASLES

In none of the exanthematous fevers are hydiatic measures contra-indicated. On the contrary, these applications often cause the eruption to appear, contrary to the general belief of the laity. Measles as a rule, run a mild course, plenty of fresh air, rest in bed, a liquid diet with free ingestion of water, a good mouth hygiene and open bowels, are sufficient for a cure, in most cases.

All writers on the subject agree, however, that hydrotherapeutic measures should be used in severe cases, especially with nervous symptoms, convulsions, stupor, delirium, high temperature, etc.—the signs of a serious infection and intoxication. The warm bath, with cold ablutions over neck and head, the warm bath gradually cooled or the cool bath of short duration—a mere dip—can be used as a powerful stimulant. In the asthenic forms the hot bath, with cold ablutions have all found their advocates, and all may be used with advantage. Temperature in measles is usually a negligible factor and the measures must be selected as indicated in each case.

If the bath cannot be given, sponging, and the cool pack instead of the bath may be used. Children do not bear low temperature and remembering this, hydriatic measures should be applied. The warm or hot bath, with a small stream of cool water applied through the nozzle of a fountain syringe to the back of the neck deepens the respiration and is an excellent remedy to prevent broncho-pneumonia.

The bath should be repeated as often as indicated, as rules cannot be given. Priesnitz bandages around the chest are useful in bronchitis.

SCARLET FEVER

Scarlet fever has to be treated like measles. No contraindications to hydriatic measures exist. The appearance of the eruption is benefited by it and the scaling is hastened. According to the unanimous opinion of the most experienced clinicians, nephritis and otitis media have never been caused by this treatment. In infants the latter is caused by vomiting, which forces infectious matter into the middle ear. The time of commencing the bath and the selection of the form depends on the indications. As in measles, nervous symptoms, or signs of a severe intoxication, call for energetic treatment. In mild cases, a warm evening bath, gradually cooled, is often sufficient to influence the course favorably. The patient is calmed and sleeps after the bath. The cold pack to the trunk, with hot applications to the extremities is indicated in cases of high temperature and cold extremities; the hot bath with cold ablutions in cases with severe nervous symptoms. Tepid or cool baths are used to lower high temperature and restore tone; the warm bath in convulsions, and so on. The indications are manifold and the measures selected must meet them.

LOBAR PNEUMONIA

The treatment of this disease with hydrotherapeutic measures has become very popular in recent years and there is at present hardly a patient suffering from pneumonia who is not treated by it. The ice bag to the head and chest, or cold bandages are frequently used, though the bath treatment is rarely employed.

There is no reason why hydrotherapy should not be more extensively used in pneumonia. Those that have used it report good results and lowering of the mortality rate. Arteriosclerosis and kidney and heart diseases usually found with advancing years, make the prognosis grave and though the treatment may not save the life of every patient affected, even in these cases, it will modify the course and lower the mortality rate. The virulence of the individual infection, and of the epidemic and the resisting power of the patient, must be considered. Each case must stand by itself and experience has to guide. The form of the bath or application must be suited to the case. The short cool bath is most frequently recommended. Cold ablutions in warm baths stimulate and may be used in almost every case. The tepid bath is especially suited for the treatment in the asthenic forms of the aged and feeble. Sponging and the pack may be employed instead of the bath and especially the former, is popular to reduce temperature and to increase tone. The effect of these measures is directly upon the peripheral nerves and by reflex upon the centers, and as a result, the function of every organ is stimulated. The nervous symptoms disappear, and the patient presents an altogether better appearance.

INFLUENZA

Influenza makes its appearance usually every winter as an epidemic of greater or lesser severity. It affects especially the mucous membranes and in recent epidemics, those of the respiratory tract preferably. It is a disease of short duration and the treatment, when well conducted, will prevent serious sequels and complications. Of the hydiatic measures, the hot mustard foot bath in bed, the ice bag to the head, sponging or pack to reduce temperature and the tepid bath, is all that is necessary in most cases.

VARIOLA—VARIOLOID

In Variola and Varioloid, a hydiatric treatment is beneficial. Ice bag to head and neck, the bath, ablutions, sponging and the

pack to reduce temperature and to improve the general condition should be used. During the stage of suppuration, the cool bath or the tepid bath have been recommended. In cases where there is much itching and discomfort the continuous warm baths have been used to advantage. Ice water compresses upon the face frequently repeated, reduce the process of scarification and according to Hebra, are superior to all other remedies. Disinfectants may be added to the water if necessary.

DIPHTHERIA

Diphtheria is almost entirely treated with injections of anti-toxin and this method yields such excellent results that at least in the majority of cases nothing else is necessary. However, there remain some in which hydrotherapeutic measures are needful to assist in the treatment and to give relief.

Ice compresses around the neck, the tepid bath with cold ablutions in the bath, sponging and friction, etc., all may be used with advantage in such cases.

MALARIA

Quinine is the remedy in this disease. The drug is bactericidal. Notwithstanding, there are but few physicians who would dispense with hydrotherapeutic measures in this disease, acute or chronic. A cold bath or cold ablutions, a cold sitzbath or douche, followed by vigorous friction and given one hour before the paroxysm is claimed to postpone or prevent the attack altogether and if postponed, to prevent it after a few repetitions. In any event this method is a useful adjuvant, if a thorough reaction can be obtained. Almost without exception, cold applications, followed by friction are preferable to hot applications in treating the acute forms. For the chronic forms various measures have to be selected to meet indications.

It seems unnecessary to discuss the hyriatic treatment of everyone of the infectious diseases. The cause, infection and the result, the local and general intoxications, with their sequels of impure blood and disturbed functioning of the viscera being the same in all. If the principles of hydrotherapy are understood and the technic is familiar to the physician, it should not be difficult to select proper measures.

DISEASES OF THE DIGESTIVE TRACT

The hydriatric treatment can be used with advantage in all diseases of the digestive tract. The irrigation of the mouth cavity and its cooling with a constant flow of water passing through a glass bulb placed in the mouth, gives relief and is curative.

The lavage of the stomach is a hydriatric measure used in everyday practice. In all chronic diseases of the stomach general hydriatric measures are called for. The cold morning dip, the warm bath with cold ablutions or douches, followed by friction etc., affect the whole system, increase the appetite and assist in removing the cause of the trouble. The sitzbath and hot applications in forms of cataplasms and thermophores, have a direct influence upon the local circulation and relieve pain. The Priesnitz bandage—"Neptune's girdle"—may be worn at night, or constantly, for the same purpose. In the treatment of the gastric ulcer, hot cataplasms over the stomach during the day and a Priesnitz bandage at night have been introduced by Leube. Under this treatment, pain usually disappears after five days. The applications are continued for ten days to prevent a relapse. Priesnitz bandages are worn for three weeks longer. In case of hemorrhage, hot application should not be used for at least three months after the hemorrhage. Priesnitz bandages should be used instead. This treatment has been generally adopted with uniform good results, when the ulcer is treated with rest in bed. Modifications may be made as indicated. In nervous dyspepsias, hydriatric measures are of great importance and it is especially necessary in these cases to select the measure, which suits the patient. The cold sitzbath of short duration and the douches may be the remedy in one, whereas a prolonged warm bath with cold ablutions or douche over the stomach may prove of benefit in another.

In peritonitis, local and general, applications of the ice bag are the rule and usually most agreeable, though occasionally hot applications are preferred. According to Cohnheim this is a diagnostic sign in "Stercoritious typhlitis, when heat is preferred, and peritonitis (appendicitis) when the ice bag gives relief". The ice bag should be suspended from a frame placed over the patient to prevent pressure. In the South, where canopies are used, it may be suspended from the tester of the bed. A Priesnitz bandage or the pack to the trunk does well in some cases. Chronic inflammatory conditions of the intestines have to be

treated just like those of the stomach, which organ is usually more or less involved. The cool sitzbath of short duration, the Priesnitz bandage or the pack to the trunk, cold douches over the abdomen in the warm bath or the intermittent cold and hot douches, are of excellent service. If diarrhoea is a prominent symptom, hot applications in some form are indicated. This is always agreeable to the patient, when locally applied in form of the hot bag, thermophore or cataplasms, or generally as full hot bath or sitzbath. Constipation is beneficially influenced by cold applications and vigorous measures in the atonic form, and by warm and hot applications in the spastic form. Meteorism and hemorrhage are treated with the ice bag; hemorrhoids with cold ablutions and cold compresses and the "cooler, and tenesmus with hot applications or steam. In the latter trouble the patient may fill the chamber partly with an infusion of hot camomile. This seems to do better than the pure water vapor, probably acting by way of suggestion. A full hot bath will often relieve severe cramps.

In the diseases of the liver, pancreas and gall bladder, the warm bath, followed by a cold application, a spray or a douche, for their general effect upon the organism, and locally hot applications or the Priesnitz bandage to improve local conditions and to relieve pain due to inflammation, should be resorted to. In gall stone colics, these measures as well as the hot sitzbath, and the hot full bath, are in general use. The itching due to diseases of the liver is relieved by a prolonged warm bath. Cold rectal injections are of benefit in icterus. In cases with ascites, the sweat bath may be tried with caution, though in advanced cases little can be expected from this measure.

DISEASES OF THE HEART AND VESSELS

A cold application, an ice bag or the use of the "cooler" slows and quiets an excited heart action, whether this is due to an organic disease of the heart, to the intoxication of an infectious disease or to a neurosis. There is no contra-indication to this application, except sclerosis of the coronary arteries and angina pectoris. The ice bag must not press upon the heart and a piece of linen or flannel should be placed between the ice bag and the skin. It should be removed every few hours and replaced after half an hour. Such an intermittent use produces a reaction and prevents freezing of the skin.

In coronary arterio sclerosis and angina pectoris, hot applications to the heart give relief, and the hot mustard bath of hands and feet is especially useful, drawing blood to the extremities and easing the over-burdened heart. This frequently stops pain instantly; though it may have to be repeated every few minutes.

Patients suffering from chronic diseases of the heart may use hardening processes to protect the organ. A warm bath, followed by a cold ablution or douche and friction, is the best measure for this purpose and even patients with a broken compensation may be treated with the tepid bath for cleansing purposes and to keep the skin in good condition.

Due to the work of physicians at Nauheim—Schott, Groedel and others—the carbondioxide bath has been introduced as an effective therapeutic agent in the treatment of diseases of the heart. The patients bear lower temperatures of the water and do not shiver in the bath, and the innumerable gas bubbles adhering to the skin produce an agreeable sensation. Peripheral vessels dilate and central vessels, especially the splanchnics, contract. Blood pressure rises, dilated hearts contract, an irregular pulse becomes more regular and its volume and frequency improves. The circulation is eased, heartwork lightened, and at the same time the vaso-motor changes force the organ to do better work. It is therapy of saving and exercise combined. Patients with advanced broken compensation, with a severe arterio sclerosis, and high blood pressure, and those suffering from angina pectoris should not take the bath. Diseases of the kidneys do not contra-indicate the treatment, except in cases where these complications exist. On the other hand, all other patients with heart weakness, no matter the cause, are suited for this treatment.

The Carbondioxide bath has to be administered according to the state of the patient and the condition of his circulatory apparatus. It is best to begin with a weak, tepid bath, of eight to ten minutes duration, three times a week and, as improvement progresses, the temperature may be lowered, the time lengthened, the strength of the bath increased and gradually it may be given with greater frequency, so that finally a bath of full strength may be administered five or six times during the week, to be followed by a day of rest. It is evident that undue excitement and exertion must be avoided, that an attendant must always be present to assist and dry the patient after the bath, and that the physician has to supervise the treatment. A course consists generally of from twenty-five to thirty baths.

Patients that cannot take the treatment with the carbondioxide bath may be treated with other hydrotherapeutic measures. The "cooler" or the ice bag to the heart, cold sponging with friction in bed, the Priesnitz bandage or pack to the trunk, cold to the back of the neck, etc.,—all serve to improve the circulation and strengthen the heart. Edemas are favorably influenced by the hot air bath to the lower portion of the body, the heart being protected by an ice bag, placed over a towel, to prevent chilling of the heart.

DISEASES OF THE RESPIRATORY ORGANS

Every cold is an infection made possible by circulatory disturbances. Chilling of surfaces, for instance, wetting of the feet is frequently followed by an inflammation of the nose, throat and bronchi. A turkish bath, a hot tub bath or even a hot mustard foot bath, in fact, any measure that will cause perspiration, restores the circulation and frequently aborts the cold.

Cold feet are the usual cause of colds, and patients, especially the aged and the feeble should change shoes and stockings when coming home and should never go to bed with cold feet. To dip the feet in cold water and to rub them dry and warm with a rough towel, or a hot foot bath before going to bed are simple measures to prevent a cold and its often serious sequels. If reaction is prompt to atmospheric changes, colds are not easily contracted, except after exhaustion and fatigue, and it must be our aim to increase the resistance of the organism by adopting measures to harden. Cold applications, given in some form to patients just out of bed, or prepared by a warm bath, are best suited for this purpose. A cold sponge in bed, a sponge bath or sheet bath, followed by friction, may be the beginning of a treatment with sensitive and weak patients. This should be gradually replaced by more vigorous measures, followed by applications of heated towels, if the patient does not react well. It is necessary to adopt these measures according to individual idiosyncrasies.

In sore throat, laryngitis and pharyngitis, if the condition is acute, an "ice cravat" gives the best results, but should be replaced by Priesnitz bandages after the acute condition has passed.

Fever, as a rule, in these cases, though often severe is usually of short duration and does not need special attention.

Acute bronchitis is to be treated in the same manner as inflammation of the throat. That is, at its onset, a sweat bath may

be tried to abort it and if this measure does not succeed, Priesnitz bandages across the chest, well secured to prevent slipping, renewed every three or four hours during the day and left at night undisturbed till morning, is a good treatment. Each change of bandage is a stimulation to the respiration and a number of deep respirations follow each application. The lukewarm bath, with cold ablutions in the bath and vigorous friction, is the best remedy to treat and prevent broncho-pneumonia. Even the very young and old may be treated in this manner. It is of the greatest value as a respiratory stimulant. The hot bath is used for the same purpose, in cases with low and subnormal temperature. In hypostatic congestion, hot applications to the base of the lungs are of value.

TUBERCULOSIS PULMONALIS

Hydrotherapy has taken a regular place in the treatment of this disease and there is no institution and hardly a general practitioner who does not avail himself of this method. The measures have to be selected to suit the state of the patient, and this has to be done with the greatest care. In the incipient form, hardening measures are indicated, with cold sponging and ablutions and friction, after a warm bath, or cabinet bath, and douches of short duration.

With weak and sensitive patients it is best to begin with dry friction every morning in bed to redden the skin, and gradually an alcohol rub is administered. The other measures are employed after the patient has become accustomed to this treatment. If a perfect reaction cannot be obtained after such a gradual and preparatory proceeding, or pulmonary hemorrhages forbid this method of treatment, absolute rest is the remedy and the patient should not be disturbed under any circumstances. Even a cleansing bath cannot be given till at least eight days after the hemorrhages have passed.

Winternitz recommends the following plan:—A cold abluion or sponge, followed by friction, morning and night; Priesnitz bandages around the chest (Kreutzbinden) changed every three to four hours and left in place at night. The ice water coil to the heart. These measures influence the respiration, produce an active hyperemia in the chest and strengthen the heart's action.

The fever of the tuberculous patients is readily influenced by hydiatric treatment and sponging is usually sufficient to reduce the temperature. Night sweats are influenced by an alcohol rub

at night or sponging with vinegar and water or steam inhalations of vinegar and boiling water, the water being gradually replaced by vinegar to one-half as the patient becomes accustomed to the somewhat irritating vapors. These measures increase the cough in the beginning and lessen it in the end by freeing the bronchi from secretions.

There is hardly a tuberculous patient who cannot be treated with hydrotherapeutic measures.

DISEASES OF THE KIDNEYS

To treat nephritis with the bath combined with the ingestion of large quantities of water, especially some particular spring water, has been a popular method for ages. Only in recent times views have changed and at the present, authorities do not agree on all points. Regardless of the form of nephritis, patients were encouraged to drink large quantities of liquids, to flush the kidneys. This is an excellent method to follow during the course of infectious diseases to prevent kidney disease and large quantities of pure water, vichy, milk and buttermilk should be administered to dilute blood and urine to protect the kidneys, if the heart and vessels are sound.

After the disease has been established, a flushing of the kidneys, freeing tubules and glomeruli from debris, is desirable and of great importance. The edema present and the state of the circulatory apparatus must guide the administration of liquids. As to the effect of the bath, it is well settled that skin and kidneys may act vicariously as to the excretion of water, and to some solids, anorganic salts and organic substances.

The views of the various observers differ only as to when and how to use these therapeutic measures.

A tepid bath will keep the skin in good condition, increase diuresis and effect a flushing of the kidneys in any form of kidney disease—it is of special value in cases where the free ingestion of liquids is contra-indicated. Hydrotherapy always furnishes a very valuable adjuvant in the treatment of nephritis and its employment is indicated: First—for the care of the skin, Second—for the treatment of chronic uremic conditions, Third—for the treatment of dropsy, Fourth—for the treatment of acute uremic attacks. The care of the skin is best attained by ordering a warm bath twice or three times a week, duration one-half hour, followed by one or two hours' rest in bed to avoid colds. All

nephritics are predisposed to colds. The temperature of the bathroom has to be carefully regulated and the clothing used after the bath must be dry and warm. Such a treatment will frequently relieve the symptoms of uremic poison, headache, loss of appetite, indigestion, etc. Sometimes the sweat bath acts better. This is given in moderation by directing the patient to take a bath of a temperature of 90°C. (104°F.) and have him sweat in a dry pack after the bath. Instead, the hot air bath in bed or the cabinet bath may be used. A combination proves sometimes of greater advantage. For instance: first day, warm bath, is best followed by rest in bed and not by a cold ablution, as is the custom. The main indication for the sweat bath is edema. There can be no doubt that edemas due to nephritis are favorably influenced by the sweat bath. Thickening of the blood can be avoided by directing the patient to drink freely during the bath. Whenever this bath is given the heart must be intact. Winternitz advises the sweat bath of the lower half of the body with an ice bag over the heart. Cold ablutions while the patient is in the hot bath are recommended in uremic attacks. This is the only condition in which cold applications have been advised. The bath should not last longer than from five to ten minutes. It is given as an excitant.

To encourage patients to drink large quantities of water in chronic interstitial nephritis, when the urine is copious and clear, is useless and will do harm. The circulatory apparatus is rarely intact in these cases. These patients as well as those suffering from chronic nephritis, with edema, should not be sent to the springs.

If the diagnosis is made as to the form of the disease and the condition of every organ is known, it will not be found difficult to select suitable hydiatric measures to treat the case.

DISEASES OF METABOLISM OBESITY

The treatment of this condition, no matter whether due to too large an ingestion of food and drink or due to inheritance, is incomplete without hydiatric measures. The state of the heart and vessels has to guide in the selection of the application. Cold ablution with friction, in the early morning, is recommended. A few hours later a cabinet bath, followed by a cold douche, a cool half bath (temperature about 20°C.) with douche or spray to the abdomen should be given. Strong patients may take a second sweat bath or dry pack in the afternoon, followed by a cold

application and friction. This and similar methods may be employed. Diet and exercise are indispensable in the treatment of obesity and must be combined with it.

The hydiatric procedures keep the skin in good condition, cold applications burn up fat, and the sweat bath reduces by withdrawing water from the system, in which the obese are over rich. It is a dessicating process. Most fat people are heavy water drinkers and should be taught to abstain. The sweat bath becomes useless for reducing purposes if the patient replaces the water lost during the bath, or immediately after it. Anything that induces thirst must be struck from the diet list. Intense thirst may be allayed by chewing the water and expectorating it. The chewing motion brings the water in contact with every portion of the mouth and is superior in this behalf to rinsing or gargling for cooling purposes.

The water treatment does more than this, it restores health by acting upon the nervous system. It improves the circulation and removes waste. The condition of the heart and vessels may call for special measures; the carbondioxide bath, etc.

DIABETES MELLITUS

Diabetes Mellitus is frequently associated with obesity and the treatment of diabetics should be directed in a similar way. However, greater caution has to be used in its application. More than in the obese, the circulatory apparatus is involved, due to the great impurity of the blood. A tendency to lose weight is common to all. This has to be taken in consideration when treating these patients. On the other hand, all are predisposed to skin diseases, and hydiatric measures to improve the circulation in the skin and for cleansing purposes, are always indicated.

GOUT

The gouty are the most frequent visitors to the Spas; yet hydrotherapy is not a specific for gout. The treatment has to be conducted on lines similar to that of the obese and the complications that are associated with the more advanced cases. Diseases of the heart, vessels and kidneys have to be considered and the patients so affected have to be treated for these diseases. During the acute attacks hydiatric measures are of little service; cold is badly borne; hot medicated lotions, the Priesnitz bandage or the inflamed joints wrapped up lightly in cotton wool may give

relief. Between attacks, hydrotherapy is indicated. The weak and the aged are best treated with a prolonged warm bath, followed by rest in bed. The temperature of the water should be made to suit the patient and the duration of the bath should not be more than a half-hour. The middle-aged and those that are still fairly strong, have to be accustomed to cold applications, so as to be better able to stand atmospheric changes. A tepid bath, followed by cold ablutions or sponging, the sponge bath, the sweat bath, the half bath, the douche, etc., may be employed.

If the patients have not used water applications previously, we have to commence cautiously and the more so, the weaker the patient, or the more advanced the disease. The chronic, gradually progressing form of gout, so frequently seen in the United States is benefited by a course of treatment with the hot bath and the sweat bath, and chronic articular rheumatism and arthritis deformans are best treated locally, as well as generally, with hot procedures, though cool applications may be added for hardening purposes. Hot local applications should be made to affected joints. The full hot bath, the electric light bath and the vapor bath, are all in use and reported to give good results in some cases. During the last fifteen years the hot air bath locally and generally given, has been preferred and in a number of cases local treatment with Bier's apparatus and his bandage treatment have improved the technic.

The sand bath and the mud bath have made a reputation in the treatment of chronic joint affections and may often be used with advantage in these cases.

Acute articular rheumatism is an infectious disease and has to be treated accordingly. No certain plan can be devised.

DISEASES OF THE BLOOD

Chorea is favorably influenced by the treatment with hydrotherapeutic measures and every one of its applications has been lauded and said to cure the disease or to assist in its treatment. Success depends on suiting the measure to meet special indications and to modify the treatment when indicated.

A large number of patients are benefited by a refreshing and toning procedure in the morning and a tiring one at night. For instance—such as cold sponging with friction, a warm bath, followed by cold sponging, the spray or the rain douche, etc., on rising, and a prolonged tepid bath at night. Instead of the above, the hot bath of short duration, or the hot bath given for a quarter

of an hour, followed by sponging or by dry pack and rest in bed may be adopted. As stated before, the hot bath is constantly used in Japan for toning purposes and may take the place of cold applications, as it is better suited and more agreeable to a large number of these patients who always suffer from cold and chilly sensations and who often react poorly. Cold applications are prohibited if a perfect reaction cannot be produced. Friction with heated and salted towels after the cold application will often cause a reaction when the simple rubbing with the rough dry towel will not produce it.

The sweat bath has its advocates and is indicated in a number of cases especially in those where hydraemia is prominent, to abstract water from the organism. The puffy appearance and edemas at the ankles call for this measure. Finally the medicated bath and the carbondioxide bath are used, the latter as a more powerful stimulant to the circulation and especially to prevent the sensation of cold. As in heart disease, it is best to commence with a bath of half strength or less and of short duration, gradually increasing to full strength and longer duration. The saline bath acts by its stimulating properties and the pine needle bath by suggestion, perhaps also by the inhalation of its vapors.

Whenever the carbondioxide bath is given the room must be well ventilated, and the patient should be protected from the poisonous gas by covering the tub with a rubber sheet.

There is no special treatment for pernicious anemia or for the secondary anemias. Attention to the intestinal tract is of great importance in all and rectal injections with normal salt solution or the Murphy Drip are indicated in most. For the care of the skin the warm bath should be used, and hot and cold measures for toning purposes. The secondary anemias have to be treated according to the underlying cause.

DISEASES OF THE NERVOUS SYSTEM

The treatment of nervous diseases has been considered a special domain for hydrotherapy and has been frequently practiced to the exclusion of all other methods in the so-called "water cures".

The results of the treatment of these diseases are favorable in many cases. The pain of neuralgias and neuritis is relieved by hot applications, and sweating, locally and generally, is of special benefit in fresh cases. It matters not in what form the applica-

tion is used, every clinician devises his own method and recommends it. It has to be adapted to the state of the disease, to the patient and to the means at hand; hot moist bandages, well covered with flannels to be changed every few minutes; the hot salt and sand sack—a stocking stuffed with either will do very well—also hot air, electric light bath, etc. The Roman and the Russian bath, the mud bath, the sand bath, or the simple hot water bath, all may be used locally or generally, or one may be alternated with the other, as indicated. In old cases, alternating procedures of hot and cold are more effective. Hot and cold ablutions, the hot and cold douche, the hot air, electric light, steam or water bath, followed by cold ablutions, sponging or douche are all good to relieve pain, and perfect cures. All act directly upon the peripheral nerves, cause an active hyperemia and free the affected parts as well as the whole organism from toxic substances.

If these affections are due to a special cause, it is of importance not to neglect this factor. A sciatica due to gout, diabetes, malaria, constipation, etc., has to be treated for the underlying cause, to be cured. The water treatment alone is not sufficient in these cases to free the blood from the special intoxicants or remove a mechanical element, such as the pressure of a tumor upon a nerve. The treatment of the organic diseases of the nervous system has to be conducted on somewhat different lines. All authors, however, agree as to the usefulness of hydriatric measures, though they differ widely in the explanation. Most accept the result obtained as an assured fact for which a rational explanation cannot be offered.

In the treatment of *tabes* extreme general measures of heat and cold are contra-indicated, whereas the milder applications are useful. A warm bath followed by a cool ablution or sponge and friction in the morning is good. A prolonged warm bath to soothe pain or as an hypnotic is also beneficial.

A cold sitz-bath of short duration to tone should be given in case of atony of bladder and rectum; hot applications to the stomach in gastric crisis combined with the prolonged warm bath. The introduction of the “cooler” in urethra and rectum, in vesical and rectal crisis and the warm moist bandages around the legs in lancing pains relieves. Not more than two of the various hydriatric measures should be applied the same day, and a regular treatment should not be continued over a month or two, though a tonic application in the morning and occasionally a prolonged warm bath at night, will always be of benefit.

The treatment of the other diseases of the nervous system has to be conducted on a similar plan: The prolonged warm bath for pain and spasms and cold applications for tone, and the continued bath for decubitus and diseases that tend to produce it, etc. In meningitis, due to any cause, the warm bath given every day with ice bag to the head, is highly recommended as a curative.

In apoplexy, hydrotherapy is an excellent adjuvant to the treatment. During the attack, the icebag to the head and back in case of cerebral congestion and the warm bath with exercises in the bath after the attack when there is no more danger from heart or vessels, is an excellent measure. This treatment should not be commenced for weeks after the apoplexy and, of course, may be modified. Sponging of the affected extremities with warm water is followed by treatment with local warm bath, for which the warm bath may finally be substituted. Friction and massage combined with the bath treatment have to be used with caution and with due consideration of the state of the circulatory apparatus.

THE FUNCTIONAL NEUROSES

In general it may be said that tonic measures are indicated in the morning, and sleep-producing measures at night. Both have to be selected with great care and their effect has to be studied and they have to be changed at once if found not to produce the desired effect. The toning application should be made in the early morning an hour before the breakfast. The night rest and bed heat have sufficiently prepared the patient for the cold application, which may consist of cool or cold sponging, cold ablutions, the half bath, the sheet bath or the dip. It is especially necessary in all of these patients to secure a perfect reaction and prevent congestions in the head. To some, cold measures are extremely disagreeable and if they do not react well, the hot bath of a minute's duration may be given instead. Others, again have to be prepared with a warm bath, or cabinet bath, etc. The weak should sip a cup of hot milk before treatment, or the application has to be used a few hours after breakfast. The tiring measures are the same as in other cases, the prolonged warm bath, splashing around in a tub filled ankle deep with cold water, the hydropathic boot, etc. It is curious to notice that in quite a number of these patients one or the other of these measures will excite, the warm bath especially, does so not infrequently, though the exciting measures, will often produce sleep, probably due to excessive cerebral anemia of these patients. Nothing can be added to the symptom-

atic treatment, which has to be selected according to indications. The Priesnitz bandage should be used in disturbances of the gastro intestinal tract—the cold sitzbath to stimulate the sexual organs and the warm prolonged sitzbath to quiet overexcitement; the ice bag to the heart in case of palpitation; the hot foot bath for cerebral symptoms, etc.

Hysteria characterized by great lability of temper, excitation and cramps, has to be treated with quieting measures to meet the indications.

In the treatment of mental diseases, hydrotherapy has found a prominent place and the soothing and tiring effect of the prolonged or continuous warm bath is daily used in maniacal conditions and states of excitement. Cold applications are employed in states of depression.

THE FEMALE GENITAL ORGANS

Hydrotherapy is used in gynecology. The ice bag, cold applications and the Priesnitz bandage are usually used, in acute inflammations, though occasionally hot applications are preferable. Heat serves to soothe pains and influence chronic inflammation. A hydriatric measure well adapted for gynecological practice is the sitzbath. A pound of salt added to the bath will make it more effective.

The bath must be prescribed with provision and its effect must be watched. The time to take it, the temperature and duration of the bath and the manner of giving it should be ordered, and if necessary, shown at the beginning. Only when this is done results can be obtained. As a rule, it is best to administer the sitzbath before retiring. If a chronic inflammatory condition is to be treated, it is the rule to commence with a warm bath—(35°C.)—of ten or fifteen minutes duration, and gradually increase time and decrease temperature. All other forms of bathing may be used to restore the general health. The local condition is usually but an expression of general ill health and cannot be remedied without paying due attention to it. General measures often cause direct improvement of local conditions, demonstrated by the large amount of mucous often discharged after a bath. The hot bath, the tepid bath and the cold bath and in recent years, the Nauheim bath are all useful to meet certain indications.

A very efficient hydriatric measure to treat local conditions, is the douche of pure hot or medicated water. Proper antiseptic

precautions must be taken and the technic must be well understood. All diseases of the female genital organs are inflammations affecting various portions of the apparatus; differing in character of chronicity, of special infection and state of the patient; and the measures have to be selected to meet these conditions. An exact diagnosis has to precede the treatment and suppuration calling for surgical interference, malignancy and tumors, have to be excluded. A great deal of harm can be done by using these valuable measures promiscuously and without special knowledge.

To the treatment of cystitis due to any cause and to that of the male genital organs, there is little to add. The prolonged warm and hot sitzbath stops pain and may be given from one to two hours' duration at a time and hot applications may be made after the bath to continue the effect of heat. The continuous bath has been used instead. Hindale quotes a case treated in the Johns Hopkins Hospital, with irrigation and the continuous bath for two years for this trouble. On admission, the bladder held not more than a tablespoonful of urine and when discharged could retain as much as 340 C. C. The patient gained in weight,—ninety pounds on admission—to one hundred and thirty-five pounds on discharge. Irrigation of the bladder and urethra are used in everyday practice for the treatment of these organs.

DISEASES OF THE EYE

Hydrotherapy covers a large chapter in the treatment of the diseases of the eye. It is a specialty and an exact diagnosis is absolutely necessary before beginning treatment. A great deal of harm can be done, more so than in any other branch of medicine, and many an eye has been sacrificed to ignorance. In general it may be mentioned that local applications especially cold and warm, moist compresses, douche and cataplasms are the most frequently used, hydiatric measures and general procedures have to be frequently combined to obtain satisfactory results. Catarrhal inflammations of the conjunctiva, hot and hyperemic, are best treated with cold applications and diptheric and croupous inflammations with febrinous exudations, with hot moist compresses. However, the whole subject is best left to the specialist, who can find extensive treatises on this subject in works on the treatment of the diseases of the eye.

CONTUSIONS AND INJURIES

Injuries of various kinds and to various portions of the body have to be treated with cold applications, until pain and bleeding have stopped. After the injured part has been thoroughly cleansed with soap and water, compresses of a solution of aluminium acetate are applied, to be left undisturbed for twenty-four hours. The treatment has to be combined with rest and if necessary by supporting the injured extremity to facilitate the return flow of venous blood, not sufficient, however, to interfere with the arterial circulation. Ointments and powders should be used as soon as the injured parts show marked signs of recovery. Burns of the first degree are treated with cold compresses of pure water or leadwater, which rapidly stops pain. Those of the third degree are treated in the continuous water bath; the temperature to be regulated to suit the patient. The burns of the second degree, that is, in cases where the skin has been blistered, are better treated with ointments and powders.

Injuries due to freezing are best treated by hydrotherapeutic means. It is known that a too sudden heating of the injured parts may lead to local and general death. The treatment is commenced by rubbing the injured parts with snow, followed by cold ablutions, and the temperature is gradually increased. The extremity is vertically suspended as soon as intense prickling pain is felt, due to the melting process and re-establishing of the circulation, at the same time the injured extremities are kept in cold moist bandages. A similar process is pursued if the whole body is frozen, the cold full bath being used instead of the ablutions. The principle is to gradually heat the frozen parts.

Wounds, suppurating sores, furuncles, abscesses and gangrene, should be thoroughly cleansed with soap and warm water. They have to be opened wide and drained to prevent spreading of the process and are then treated until decidedly improved with warm moist bandages wrung out of some antiseptic solution. Then powders and ointments have to take the place of the moist bandages. The continuous bath, local or general, has to be employed in some cases to prevent pressure and to facilitate the softening and cleansing process.

Lymphangitis, with swelling of the glands, acute and chronic, is treated with warm, moist compresses and the tepid bath. If the glands show signs of suppuration, they have to be opened. Even in injuries to bones and joints, a treatment with hydrotherapeutic measures is frequently a very valuable aid.

CHAPTER VII

ELECTROTHERAPY

Electricity, in its various forms of application, acts directly upon the nerves and through them upon the muscles and organs. It improves function, causes a better blood-distribution and a freeing of the blood from impurities. The method has been used as a therapeutic agent for more than a hundred years, that is, since the discovery of the electrical machine and the celebrated experiments of Galvani and Volta. After the discovery of the induced current by Faraday and the great improvement that followed in the apparatus and its combination with the magnet, this form of application attracted for a number of years the attention of the medical profession and local Faradization was commonly used in the treatment of the various forms of paralysis and paresis, muscular atrophy, neuralgias, sensory disturbances and other affections of the nervous system.

In 1856 R. Remack studied and re-introduced the application of the constant galvanic current and proved the superiority of its use in a number of diseases.

Many investigators believe that it acts mainly by suggestion. According to Moebius four-fifths of all cases treated and cured by this means are due to its psychic influence upon the organism. Its curative effect upon paralysis and paresis due to organic lesions, has not been proved and its influence upon menstruation, intestinal peristalsis, vasomotor disturbances, pain, etc., can be readily explained by suggestion. There remain many enthusiasts who believe in the superior efficiency of electricity as a therapeutic agent, without attempting to explain its action, and a large number that discard its therapeutic value altogether. R. Remack emphasizes the importance of the electrotherapist taking a position on this question. As for the suggestionist, it would be quite immaterial in what manner the electricity is applied. This author concludes that on account of the immediate effect of electricity its physiologic action cannot be questioned.

Electricity is a valuable therapeutic agent, which can be employed with advantage in many diseases. Its direct action upon the nerves and the immediate effect it produces upon the circulation and the functioning of the organs is proven beyond all doubt.

Electricity can be applied in various forms—single nerves and muscles, and groups of muscles and organs, can be treated with great exactness, as indicated by the diseased condition.

It is no doubt correct that suggestion is an important factor in the numerous splendid results obtained with this treatment, but I cannot see why anybody should object to this, or even try to separate it from the purely therapeutic effect of electricity. In fact it would be difficult to do, if not entirely impossible. Suggestion is a factor to be counted in the efficacy of any therapeutic method, whether it is with douches or with serum, with massage, pills or with powders, and though it is usually neglected and only unintentionally employed, it does its good or harm, whether used by the skilled or unskilled. No method acts well alone. Suggestion, air, diet, exercise, rest and drugs have to be considered in every case, and the final goal towards which we have to strive, a pure blood and improved circulation, can be attained best if we combine with purpose and intention some or all.

Electricity is a force, known by its manifestations, resembling heat and light. It is impossible to define it. It exists everywhere, but in such perfect equilibrium, that we are not conscious of its presence, unless this is disturbed. It then manifests itself by trying to regain its balance. The manifestations of electricity may be modified by various contrivances. Three distinct forms are known: Static, that is electricity in a state of rest; the constant or galvanic current, i. e. electricity in a continuous flow, and the induced or Faradic current—the vibratory or alternating current.

Electricity produced by friction was known to the ancients. Rubbing a glass rod with silk, or amber or sealing wax with a piece of flannel, electrifies these substances. It disturbs the equilibrium of the electricity they contain and the glass rod becomes positive electric, the sealing wax and amber negative; that is, the rubbing separates the electricity and collects the positive on the glass, the negative on the silk, and the negative on the sealing wax, the positive on the flannel. If brought in contact, it will be found that like repel and the unlike attract each other. The goldleaf electroscope,—a simple apparatus consisting of two gold leaves attached to a wire and protected by a glass bulb from air currents and moisture, serves to ascertain whether a certain substance contains positive or negative electricity. It is charged by bringing the substance in question in contact with the wire of the instrument, causing the gold leaves

to diverge at once. The charge is then tested with an electrified glass rod. If the electroscope contains positive electricity, the leaves will diverge still more and if it contains negative electricity, they will collapse. All substances may be electrified by friction, and all conduct electricity, some more, some less. The metals and their solutions are good conductors. Silk, sealing wax, dry skin and similar substances, are bad conductors and are called insulators. If a charged substance is brought near an uncharged body it induces equal and opposite charges on its sides or ends. For instance—an isolated positively charged body brought near an isolated metal cylinder causes negative electricity on the further end.

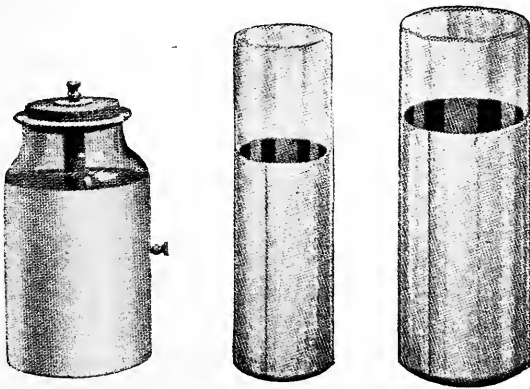


Figure 1—Leyden Jars—Dorflinger Style, Schneidel Style, Western Style

To condense electricity the Leyden jar is used. Volt, Ampere and Ohm are measurements of electricity.

E. M. F.—Electro motorforce or “voltage” forces that move electricity, and the volt, which is the unit of electro motorforce, are about equal to the pressure exerted by one Daniell’s cell.

Amperage is the rate at which electricity flows, and the ampere is the unit of current, that is, as much electricity as can be pushed through a resistance of one Ohm by one volt pressure.

The Ohm is the unit of electrical resistance and is about equal to the resistance offered by a piece of copper wire two hundred and fifty feet long and 1-20 inch thick.

A galvanic cell consists of a plate of carbon and a plate of zinc immersed in an exciting fluid. Chemical decomposition at

the zinc causes positive electricity to flow to the carbon and out of the cell through a wire that connects the elements.

All galvanic batteries for therapeutic purposes are connected in series to get a large voltage to overcome the resistance offered by the human body. That is, the zinc of a cell is connected by wire with the carbon of the next and so on. If the resistance is slight and a larger quantity is desired, as for instance, in galvanocautery, all the zinc plates and all the carbon plates of the cells are connected.

The Watt is the unit of power. It is obtained by multiplying the Volts by the Amperes. Seven hundred and forty-six Watts are equal to one horse power.

Electricity is measured according to the Ohm law. "The strength of the current passing through any part of a circuit varies directly as the difference of potential between its elements, and inversely as the resistance of the circuit itself.

Current in amperes is equal to the electromotor force divided by the resistance in Ohms, or the formula $C = \frac{E}{R}$

C = current in amperes, E = electromotor force, R = resistance in Ohms.

The electro motorforce E , is not constant, and the resistance varies constantly according to the place of the body to which the electrode is applied.

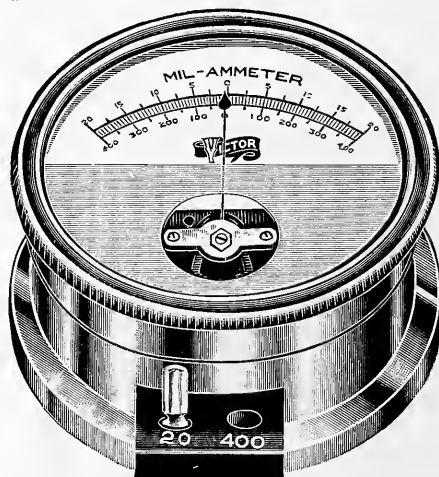


Figure 2—Milliampere Meter—In the field of a permanent magnet of horseshoe shape, swings a pivoted coil in opposition to spiral springs. The deflection of this coil to which the indicator is attached, is in direct proportion to the intensity of the current it carries.

The current passing through the patient is measured by an instrument called the milliamperemeter. Without such a meter, dosage cannot be determined and with it, sensibility and resistance of the patient does not matter. The instrument marks the amount of current. To increase or decrease resistance in the circuit, a rheostat is important to control the amount of current passing through the patient. Increase of resistance diminishes flow of current not affecting the voltage and produces heat directly proportionate to the resistance. It is of great importance in electro therapeutic work to remember the polarity of a battery. The poles have distinct and definite properties. The course of a current in a circuit starts at the point of greatest chemical decomposition and flows from the higher to the lower level, from the zinc to the carbon, that is, from the anode or positive pole, to the cathode or negative pole in the internal circuit and thence from the carbon of the anode or positive pole to the zinc, the cathode or negative pole in the external circuit.

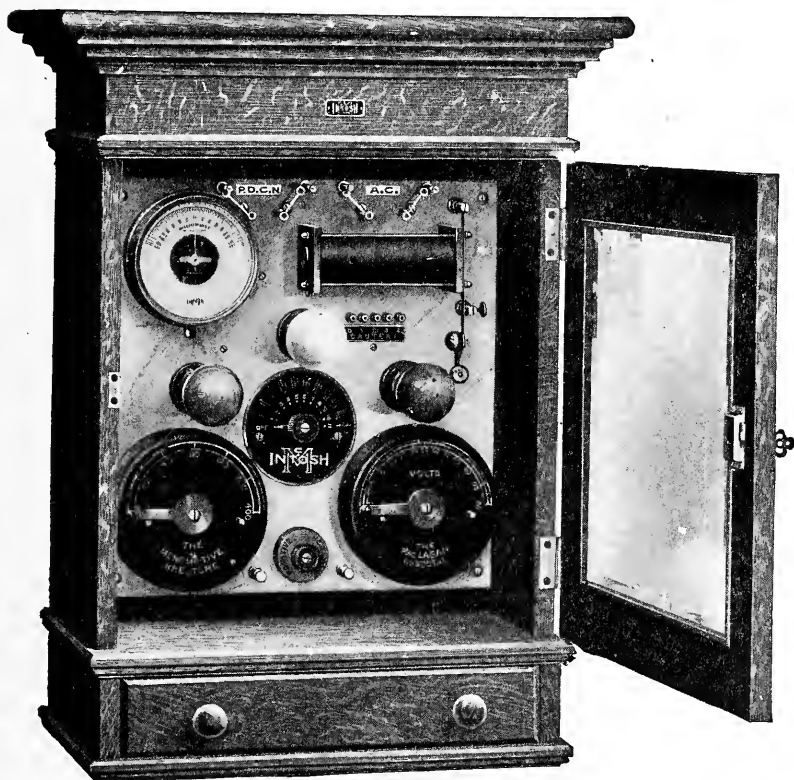


Figure 3—Therapeutic Wall Cabinet

The positive pole acts as a sedative, blanches the surface, contracts the capillaries, stops pain and produces acid. The negative pole, reddens the surface, widens capillaries, liquifies tissues and is alkaline and caustic in reaction. Oxygen develops on the positive and hydrogen on the negative pole. The polarity is easily tested by dipping the two free ends of the wires in a tumbler of water, holding the points about one-half inch apart. The point which bubbles most is the negative. The bubbling is due to the evolution of hydrogen, owing to the decomposition of the water. An electric current passed through the solution of a metal or a salt of a metal breaks it up into two parts called Anions, water is divided into its elements, oxygen and hydrogen. The latter has all the properties of a metal. The process is called electrolysis. Anions, the electro negative substances of the solution, collect at the positive pole, repelled by the cathode and cations. The electropositive substances of the solution, collect at the negative pole, repelled by the anode. The negative pole liquifies and destroys. This has to be remembered if electrolysis is employed for destruction of diseased tissue, moles and warts.

Galvanism acts upon muscles and organs below the skin, and it is, therefore, necessary to use well covered electrodes, saturated with warm water, to overcome its great resistance. The application should be made with some caution to avoid burns. The electrode at the indifferent pole has to be large and the easily bent lead electrodes are especially useful for this purpose. To judge the effect and dosage of the method, it is necessary to state amount of current, size of electrode and time, and duration of application.

The method is useful in the treatment of paresis, paralysis and atrophies of muscles. It induces stimulation of nerves and muscular contractions, thereby improving blood distribution and it is thought influences directly diseased nerves. The technic consists in producing muscular contractions by opening or closing, or by moving, a well moistened electrode rapidly along the diseased nerve. This is the usual way of applying galvanism in paralysis and paresis, though occasionally the constant current, without interruption, may be used for the same purpose, the cathode to be employed as the active pole.

The constant current is especially useful for its sedative effect, and its property to soothe and to relieve pain. The positive pole has to be employed as active pole. If for instance, the anode is placed upon an inflamed and painful joint, no matter

whether the injury is due to rheumatism or trauma and the constant current is allowed to pass for some time, the pain will stop, even in severe cases, for some hours, and the mobility of the joint will be increased. If the treatment is continued, permanent improvement and cure will follow. A similar success may be obtained in some cases, if the nerve trunk containing sensitive fibres leading to the injured part is treated with the galvanic current. Severe neuralgias of the trigeminus are frequently successfully treated with weak currents, the anode being placed upon the painful point. The application has to be carefully made, that is, the strength very slowly and gradually increased, or applied and decreased before removing the electrode.

Remard and Rumpf report such cures after every other means and even nerve-excision had been tried without success.

The prolonged application of such weak currents is recommended. The treatment also may be given across the head, with the Gasserian ganglion in line of connection. The use of weak currents in severe trigeminus neuralgias is unanimously recommended.

Tinnitus aureum, due to middle ear catarrh and Meniere's disease, have been successfully treated with the galvanic current and high frequency. Habit spasms, Tic-Chorea and tenany have occasionally been benefited by its sedative action. The application of galvanotherapy is empirical and it is necessary to individualize its use. Some have reported good results with strong currents and others treating the same affections, for instance, sciatica, recommended weak currents. It seems best to commence in every case with the application of weak currents and to slowly and gradually increase to the strength necessary.

The selection of the pole and the dose are of importance in the application of this method, though it cannot be denied that in certain cases the curative effect is not dependant on the position of the poles.

Inflammatory conditions often rapidly improve when treated with the galvanic current and exudates are softened and absorbed. As mentioned before, the chemical action of the current and the decomposition of the electrolyte into ions, charged with opposite electricity, passing to the poles, have been called upon to explain this effect of the current, though its action upon the blood and lymph distribution, shown by dilation and reddening of the surface in the organs and structures located beneath, is generally accepted.

This would satisfactorily explain the sometimes remarkable curative effect the employment of the current has given in the treatment of indolent buboes, enlarged prostate, hard old scars, chronic rheumatism and many other similar affections. The results obtained in the treatment of neuritis "mono" and polyneuritis are above question. The treatment with the anode to relieve pain, and the treatment with the cathode to produce stimulation and muscular contractions often leads to improvement and recovery, and both have been thought due to the same influences.

The treatment of the sympathetic nerve is one of the most useful and popular applications of the galvanic current in Exophthalmic goiter, when applied to the neck, hemiplegia, in hemiplegia, asthma, angina pectoris, nausea and headache of the hysterics, neurasthenics, etc. The results obtained have not been explained and by some are claimed to be due entirely to suggestion; by others to vasomotor influences and the catalytic effect of the current. Similar results have been obtained and like explanations have been given in the treatment of the diseases of the spinal cord and its meninges, as in tabes dorsalis and chronic myelitis, spastic spinal paralysis, chronic cerebro spinal meningitis and others. Every symptom of these diseases, pain, bladder and rectal paralysis and paresis, spasms and paresthesias, ataxia, etc., have all been modified and often entirely relieved and the general course of the disease has been favorably changed by this procedure. The application has to differ with the disease. If it is desired that the current pass through the whole cord, one of the poles must be placed over the cervical and the other over the lumbar region of the spine; or, the active pole is slowly passed along the spine and the passive pole fixed over the cervical portion, or over the sternum. If the diseased process is localized, one of the poles, usually the anode, is placed over the diseased portion and the paralyzed muscles and nerves are treated at the same time with the cathode. The electrodes must be large to allow currents of great density to enter the spine. The functional neurosis, hysteria and neurasthenia and the spastic neurosis, paralysis agitans, tic, etc., have been treated successfully by passing weak currents through the spine. These have given the best results. The galvanic current applied to the head affects the cranial nerves and frequently causes dizziness, nausea and even vomiting, depending on the sensibility of the patient to this agent, and in defects of the skull, the stimulation of the motor area of one side has produced convulsive movements of the extremities

of the other side. This can not happen with an uninjured skull. Galvanization of the head has been used in the treatment of cerebral hemorrhage, by passing the current from front to back, from temple to temple, or in any other direction, bringing the seat of the trouble into the connecting line between the two poles. The best points for the current to enter the head are at the mastoid processes, the points below the ear, where the skin is thin and tender; the temples are also favorable points. The forehead offers greater resistance and the hairy scalp is still more unfavorably affected.

The treatment should not be commenced before three or four weeks after the attack. Large lead electrodes fitting the head should be used and weak currents with careful and slow increase and decrease employed. A few minutes' application should be sufficient. The direction of the current is entirely immaterial. The explanation of its action is always the same: The chemical and catalytic effect and the influence upon the vasomotor apparatus. That the blood distribution in the head is affected according to certain laws, has been experimentally proved. Bulbar paralysis has been favorably influenced with this treatment, that is, speech and deglutition have been improved, and other affections of the brain have been similarly treated with some success. Paralysis agitans, and the headaches of the neurotics, are frequently relieved when treated with galvanization of the head. The function of every organ can more or less be influenced. The diseases of the stomach have been long treated by this method, it is especially the stomach neurosis that yields the best results, though the gastric crisis of tabes dorsalis, with large electrodes applied to the epigastrium, and coeliac plexus, and the vomiting in pregnancy, have been successfully treated with galvanization. Intestinal peristalsis can be affected and chronic constipation can be benefitted if treated with the constant current. One of the poles, preferably the anode, is introduced into the rectum, and the other, the cathode, a large electrode, placed upon the abdomen. Here, as elsewhere, it is best to commence with weak currents, though good results have been reported from the employment of weak and strong currents, each method having its advocates. The visceral neurosis of the abdominal organs, and lead colics, have been treated successfully with the galvanic current. The heart function is influenced and direct application of large electrodes over the spinal column and precordial region, passing currents across cause a general

strengthening of the hypertrophied and dilated organ, which is shown by more regular and stronger contractions. The sinusoidal current gives still better results.

The sexual neuroses and visceral neuralgias of the male and female genital organs, which affections are of frequent occurrence, almost invariably improve under treatment with the galvanic current, as also the affections of the bladder. In incontinence, the poles placed in front and back, so that the current passes through the diseased structures gives relief.

General galvanization has been recommended by placing a large cathode over the epigastrium and moving a small anode over every portion of the body, head, chest and back, especially along the spine.

This method advised by Beard has given good results in his hands in the functional neuroses, in angina pectoris, in diabetes mellitus and in a number of skin diseases.

The principles of *electrolysis* are used to introduce medicines into the body and the process is then called *Cataphoresis*. A medicine consisting of a solution of a metal or alkaloid, placed upon either of the poles of a galvanic battery, is decomposed into its ions. The anions—electro-negative—collect at the positive pole and the cations, electro-positive, collect at the negative pole. All bases, metals or alkaloids are electro-positive and all acids and substances that can take the place of an acid, are electro-negative. If the action of the base is desired, the medicine has to be placed at the positive pole, so that after decomposition it has to pass through the tissue to the negative pole. If the action of the acid is wanted, the medicine has to be placed at the negative pole, for the same reason. Metallic salts, especially copper salts in solution, are very strongly antiseptic and this property is made use of in electrolysis. Decomposition takes place and the finely suspended copper forms a chloride and is deposited in the tissues. The process can be used wherever germicidal antiseptic action is desired.

THE FARADIC CURRENT

Faraday found that in a closed circuit a current is induced as often as a magnet is brought near it, and that a current passing through one circuit induces a current in another nearby, but detached from the first on making and breaking the current—that is, on opening and closing the circuit.

Upon this observation is based the Faradic or induced current obtained by magnetism. A coil of wire, the primary coil, connected with the battery surrounds a core of soft iron and conveys the current that will convert the iron into a magnet. A second, the secondary coil, is placed near and insulated from the first. Induction currents are produced in both coils by opening and closing the circuit. That is, whenever the iron core is converted into a magnet and on return to the original state, a little hammer placed opposite the end of the iron core serves as interrupter, closing and opening the circuit as the iron is converted into a magnet, and as it loses its magnetism when the current ceases to flow, a constant to and fro movement, between iron core and coil is the result. The current induced by the starting of the inducing current, flows in an opposite direction and the current induced by breaking the circuit, flows in the same direction as the inducing current. The more rapid the interruption, the greater the electro-motorforce.

FARADOTHERAPY

An induction apparatus with sufficient current may be used for this purpose. The cathode is employed as active pole on account of greater exciting power which is controlled by changing the position of the iron core—that is, drawing it out and pushing it back. Current strength is increased and decreased and is measured by a scale affixed to the apparatus. If organs located beneath the skin, nerves, muscles, joints, etc., are to be treated, two electrodes, well covered and saturated with moisture, should be used, and if an irritation of the skin is intended, one of the cathodes

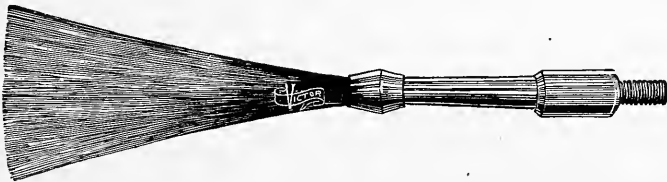


Figure 4—Metallic Brush



Figure 4—Curved Vaginal Electrode

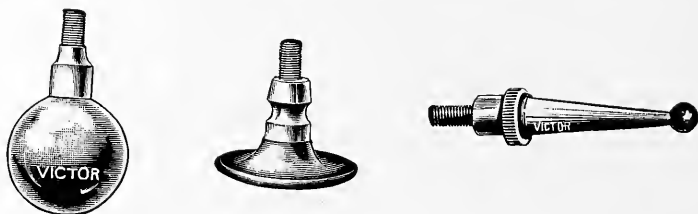


Figure 4 Ball Electrode, Disc Electrode, Erb's Electrode

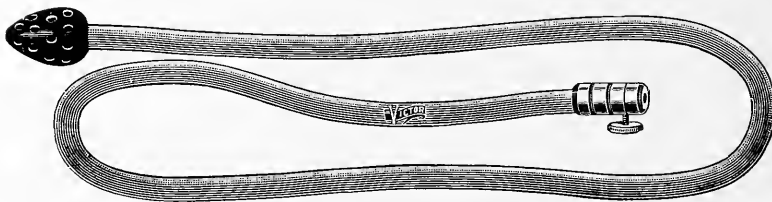


Figure 4-- Stomach Electrode

is employed dry in the form of a metallic brush and the anode as moist electrode to convey the current. For the treatment of stomach, vagina, rectum and other cavities of the body, suitable electrodes, usually shaped like olives and fixed with insulated handles, are used.

Faradization is employed to cause contraction of the voluntary muscles by placing both moist electrodes upon the muscles in close vicinity to each other, or by placing the active pole upon the motor points, when such points are known, or finally to use Faradization of the nerve trunks for this purpose.

Muscular contractions produced by the Faradic current are tetanic in character and are especially of value in cases of *asphyxia* due to chloroform, carbonmonoxyde, alcohol, poisoning, etc. In such cases life has been saved by stimulating the phrenic nerve from its motor-point in the neck, to produce contractions of the diaphragm and artificial breathing for any desired length of time. Irregular respiration and asthma of the hysterics have been cured by this method. As a means of passive exercise, it has proved of value in the treatment of paralysis and muscular paresis, as well as by suggestion in these affections of the hysterics. Only weak currents should be employed, especially if organic lesions of the nervous system are the basis of the paralysis, and these may be combined with the use of the constant current, which has a decidedly superior curative effect in such cases. Strong Faradic

currents cause paralysis of nerves. The Faradic current has practically no sedative effect, though in a few instances it has relieved pain thought to be caused by its paralyzing effect. Cures of migraine have been reported by employing moist electrodes and passing the current through the head from forehead to base, or vice-versa.

Hysteric pains have been favorably influenced and often have been cured by treatment of the painful spots with the Faradic brush. Suggestion probably explains this action. If the first few applications do not effect a cure or at least cause a decided improvement, the treatment had better be discontinued and changed, as it does not promise much, if it fails in the beginning. Anaesthesias due to any cause, are favorably influenced by treatment with the Faradic brush. In hysteria, a few applications are frequently sufficient to cure, and when tabes dorsalis hemiplegia or some other organic lesion is the cause, improvement has often been noticed. Influence upon the vasomotor apparatus has also been observed, thought to be the cause of this curative effect. Rheumatic affections, acute and chronic, of muscles and joints, have been successfully treated with this current, though, according to the consensus of opinion, the treatment is inferior to that with the galvanic current. Occasionally it may be well to use both intermittently. The treatment of Basedow's disease with the Faradic current has given good results in the hands of some clinicians.

Faradization of internal organs has been largely used. In the diseases of the stomach, this organ has contracted and become smaller when treated by this method. Good results have been obtained in hysteria and in chronic gastric catarrh the mobility of the stomach has been increased. Some have recommended the introduction of one of the electrodes into the stomach, filled with water with the external application of the other electrode, and others have used both electrodes externally.

Einhorn claims that his method is of special benefit in the treatment of enteroptosis. Patients afflicted by this disease are invariably hysterics and neurasthenics and his success is likely entirely due to suggestion.

Internal peristalsis is increased, which fact has been proved experimentally, and constipation often cured—the effect is augmented by the introduction of one pole into the rectum. General Faradization has been introduced by Beard and Rockwell, and has been found to give excellent results in the treatment of the func-

tional neurosis, hysteria, neurasthenia, melancholia and hypochondriasis and in all cases of general weakness, including chlorosis and the anemias. Individualization is necessary in this, as it is in the application of any other therapeutic method.

The patient is so seated that his feet touch a moistened, heated, flannel covered copperplate, connected with the negative pole, and during this time the cathode is moved over every portion of the body, and the current changed in strength to suit the sensibility of the parts treated—duration from fifteen to forty-five minutes. The treatment is commenced with face and head turned downward. In cases of insomnia; improvement of appetite, digestion, constipation, increase of body weight and general mental and bodily tone follow. Instead of using the foot plate, the patient may be seated upon a metal shield covered with flannel and the electric massage-roller used as an active electrode. The selection of the poles is entirely immaterial. The electric bath has largely taken the place of this form of general Faradization, the water acting as an electrode, applied to the whole body, though its use is limited to institutions, on account of expense and lack of space. Care must be taken to prevent grounding of current—the tub must be insulated.

THE SINUSOIDAL CURRENT

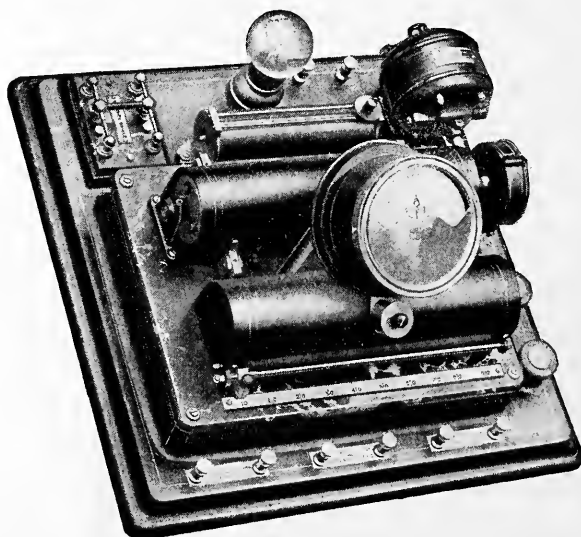


Figure 5—Multiplex Sinusoidal

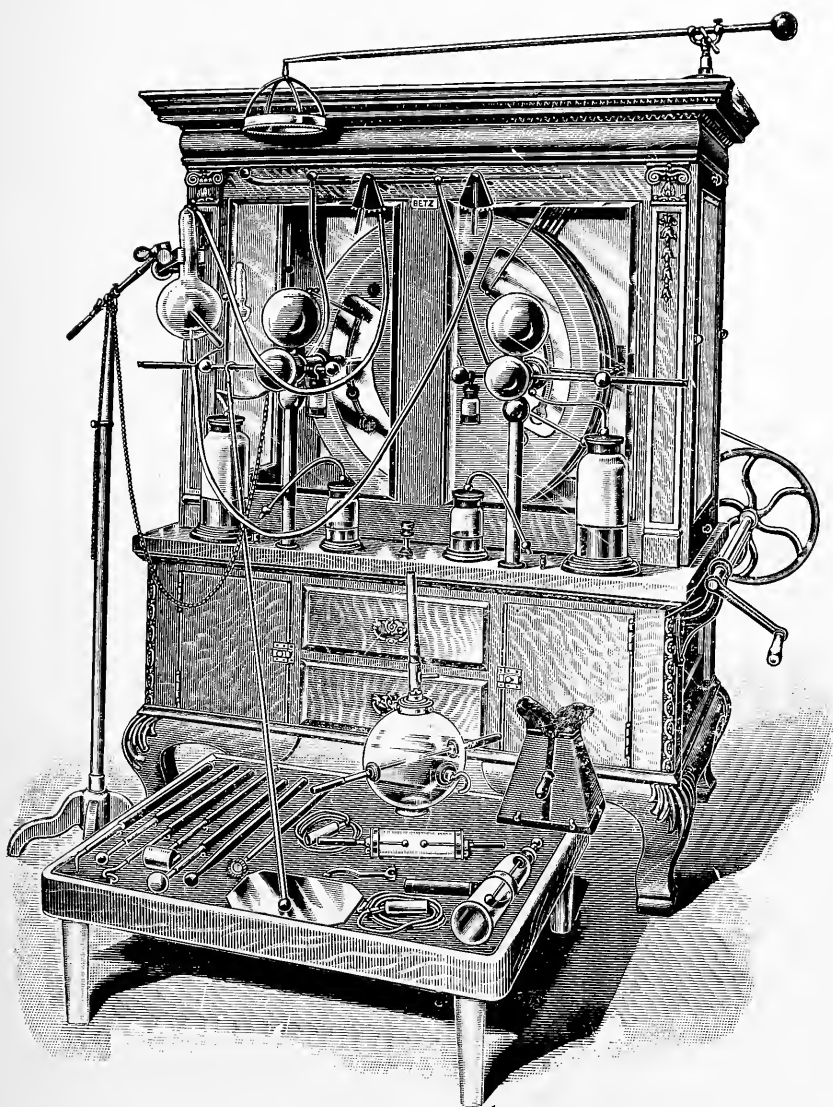


Figure 6 -Static Electric Machine.

An alternating current, which constantly changes its direction of flow, is called sinusoidal. When the voltage gradually rises and falls it gives rise to currents that correspond to a true sinuscurve. On account of cheapness of transmission, alternating currents are usually produced by a dynamo. A closed circuit, rotating between the poles of a magnet induces an alternating current, producing a complete cycle for each revolution. By means of a transformer, alternating currents of any desired voltage may be obtained from the original current and the alternating current may be converted into a direct current by a suitable apparatus—the convertor. The sinusoidal currents are preferred for the therapeutic purposes when a deeper action of the current is desired. They cause deep muscular contractions, especially deep structures, which are painless, and they are also recommended in the treatment of muscular atrophies, as exercise, and in rheumatic affections of muscles and nerves. They stop pain and act as a sedative. More current is required to excite motor-nerves than is necessary when the Faradic current is used.

The principles of static electricity have been mentioned. Its main feature is practically constant. The amount of current is so small that a hundred thousand volts or more, may be safely given to a patient. Various machines are in use. The Wagner, Toeplar Holtz, the Holtz & Comp-Machine in this country, the Wimshurst in England and the Eulenburg Hirschmann machine in Germany are the best known. The usual method of applying static electricity is by means of the static bath. The patient sits isolated upon a platform connected with the positive pole of the machine, the negative pole connected with the floor and grounded. He is then charged with positive electricity as soon as the machine is set in motion. When used as a sedative, duration should be from five to ten minutes. It is useful in the treatment of the functional neuroses. Sleep and appetite are improved. A modification of this is the static head douche. The patient sitting upon a platform, is charged with positive electricity, and the negative pole is brought near the head. This gives an agreeable sensation of a warm rain trickling upon the head. The effect is sedative and relieves headache. (Figure 6).

Another modification is to allow sparks to pass. The patient sits upon a platform, the electrode is brought near him and rapidly removed, so that not more than one spark passes at a

time. The negative pole is connected with the floor. This method is used in the treatment of paresthesias, pruritus, neuralgias and tinnitus aureum. (Figure 7).

HIGH FREQUENCY CURRENTS

For the purpose of using these high tension currents, two Leyden jars are charged, usually from an induction coil, through a static machine, or a high potential alternating current transformer may serve the same purpose. The poles of the secondary spiral of the induction coil are connected with the inner coating of the two Leyden jars, from which protrude two vertical metal rods, also connected with these coatings. Two horizontal metal rods are passed through their upper ends, ending in balls that can be brought more or less close to each other, and by pushing and pulling the length of the spark is regulated. The sparks that pass consist of oscillating currents of such frequency that they appear uniform to the eye and produce on the outer coating of the Leyden jars alternating currents of enormous tension and frequency, more than a hundred thousand oscillations per second. With each oscillation the charge of the inner coating is reversed, and this induces instantaneously a reversal of the current in the outer coating.

The currents are passed with a spiral, to the end of which electrodes are attached, which when grasped by the patient cause the high frequency currents to traverse the body. No shock or disagreeable sensation is produced, notwithstanding a lamp placed in the circuit will glow with great brightness and the current may be a half ampere or more, enough to be dangerous, perhaps fatal, if constant currents were used.

Auto-Conduction—These treatments are given with an auto-pad arranged in two parts. By this means the patient may be placed on the pad in the center of a series of waves that have a very decided tonic effect. The treatment may also be administered by placing the patient in the center of a solenoid of wire, or a smaller solenoid may be employed for the treatment of the limbs.

Auto-Condensation—In these treatments the patient sits or reclines on an auto-pad, consisting of a metallic plate insulated from the body. The action is similar to that of a Leyden jar, the patient being one coating and the other the metal plate; separated by the dielectric. In this manner it is possible to saturate the

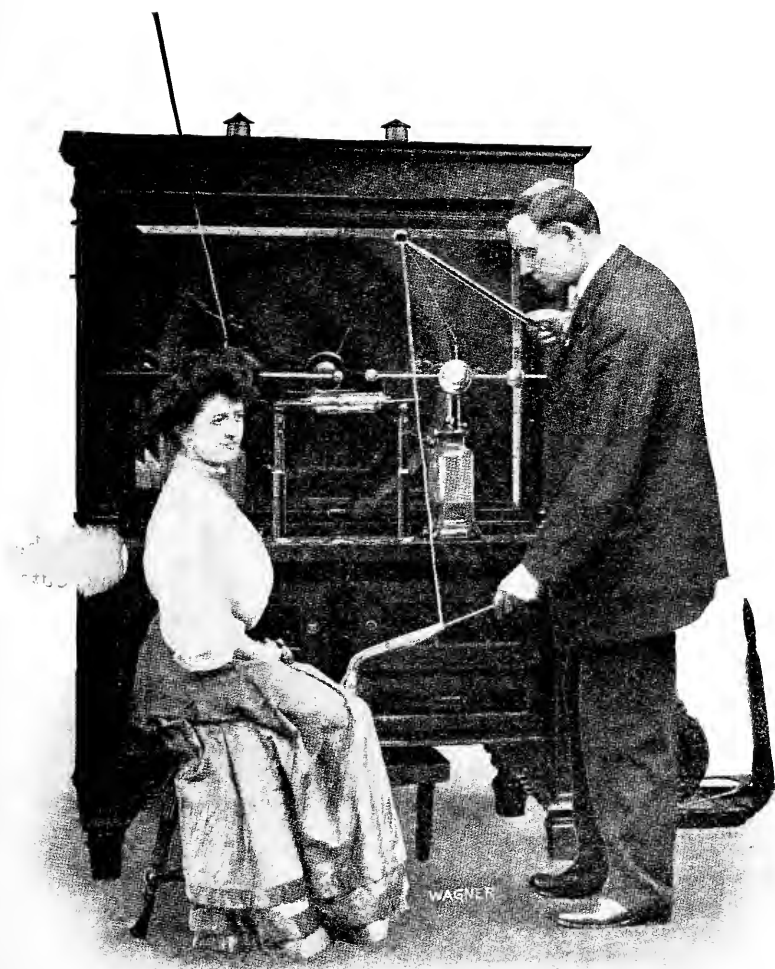


Figure 7

entire body with this current, showing mark dilation of the blood vessels, and therefore, a lowering of the arterial tension. The elimination is increased and cellular and tissue action stimulated. The current is without sensation, and although many experienced operators claim that 400 milliamperes are sufficient to produce the desired results, 200 to 1,000 milliamperes may be administered.

Such a general application increases metabolism, and causes augmentation of combustion, shown by an increase of excretion of urea and influences the vasomotor apparatus. It has been recommended in the treatment of diabetes, gout and rheumatism, though the results of recent investigators are not uniform. This method of treatment has been also favorably reported upon in the treatment of arterio sclerosis, especially of the presclerotic stage, to reduce blood pressure, "Moutier & Gay". However, further investigations are necessary in this direction.

Insomnia, depression, nervous cough and similar affections are favorably influenced. The local application is especially useful—reddening of the treated portion of the skin is followed by blanching and anesthesia after the removal of the electrode. The anesthesia lasts for about fifteen minutes. Oudin has developed its application for the treatment of the diseases of the skin, and Regnier and Desbury have noted the anesthetic effect during operations on the teeth.

THE ELECTRIC BATH

A uniform application of electricity, that is, a general galvanization or Faradization, may be obtained in a most excellent way by using the bath; the water taking up the current, acts as an electrode and adapts itself in the most perfect manner to every portion of the body. The sinusoidal current may be used as well. (Figure 8).

Various forms of currents are used in the monopolar bath. The patient, placed in a tub of warm water, grasps with both hands one of the electrodes, a hollow metal rod, well covered with moist leather and placed across the tub; or better, he lies on his back upon a metal shield, surrounded by a rubber cushion filled with water; or instead, one of the electrodes isolated from the water, may be placed upon the patient. At the same time, the other electrode is placed in the bath to convey the current. In this form the whole current passes through the body. In the bipolar bath, both electrodes are inserted in the water and only a small portion of the current passes through the patient,

because the resistance of the body is greater than that of the water. If the bath tub is divided into two compartments by a rubber diaphragm, as is done in Gaertners two-cell bath, the body of the patient passing through the opening of the diaphragm, then the whole current is forced to pass through the patient, just as in the monopolar bath.

Eulenburg has called the monopolar bath, the Cathode bath, when the cathode is inserted into the water, and the Anode bath, when the water contains the anode.

The physiologic and therapeutic effect of these various forms do not differ much. They usually consist of lowering blood pressure, decrease of pulse frequency and respiration, increase of excretion of urea, improvement of appetite, intestinal peristalsis and also digestion. On account of its greater stimulation, the Faradic bath is usually preferred for general application, though if a sedative effect is desired, as in paralysis agitans, chorea, Basedow's disease and similar affections, the galvanic bath is of greater advantage.

Porcelain tubs are best for the electric bath, though wooden and metal tubs may be used for the monopolar bath, if lined with linoleum. However, for the bipolar bath, the bath tub has to be made from some non-conducting material, wood, porcelain or lackered tubs. Care must be taken to prevent grounding of the current as serious injury may follow.

The temperature of the water may be a little below body temperature, as chilly sensations are somewhat prevented by the skin irritation of the current. Duration of the bath—five minutes—gradually increased to thirty minutes.

The Faradic bath always has a refreshing and toning influence and its suggestive effect makes the method especially useful in the treatment of the functional neuroses. The electric hand-bath and footbath has been used for many years in rheumatic and gouty affections. The advantage of a hydra electric bath consists in the water being the electrode giving large surface of application and its perfect adaptation to the body or extremity treated.

Both electrodes, or only one, may be immersed in the water, the other connected with the patient. This measure has been successfully used in the treatment of Raynaud's disease, paralysis of the muscles, rheumatoid, arthritis, etc. A. Fossier treated a case of Erythromelalgia (Weir Mitchell's disease) of the foot,

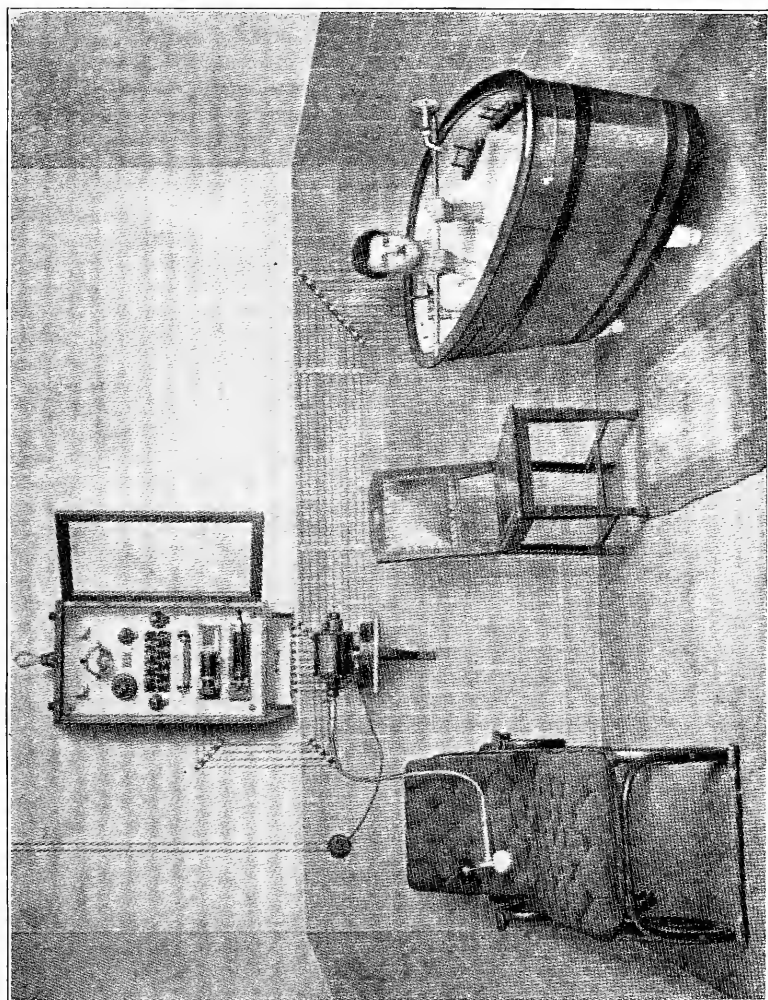


Figure 8—Hydro Electric Bath, for Galvanic, Faradic and Sinusoidal Currents

combining the treatment with injections of Sodium Cacodylate, with perfect result.

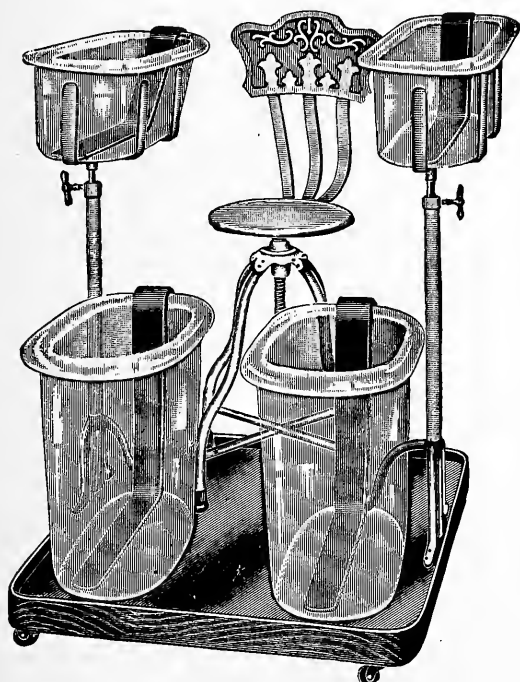


Figure 9—Four-cell Bath

The four-cell bath of Dr. Schnee consists of a wooden bath chair to which four cell-basins are attached, connected with carbon electrodes and a switchboard. The arms and legs of the patient are placed in the cells filled with warm water, connected with suitable apparatus furnishing galvanic, sinusoidal and Faradic current. The various basins can be connected with the anode or cathode by means of contact plugs. A large number of combinations can be made in this way, passing ascending and descending or cross currents through the patient. A current of large density can be passed through the patient by connecting one extremity with the anode and the other three with the cathode. Good results have been reported in the treatment of neuralgias due to various causes, joint affections and paralysis, though according to Remark, it is not superior to the usual above described method, which can be employed in the office.

Electricity stimulates nervous tissues and through them the function of every organ in the body, it stimulates the vasomotor apparatus, and through it influences the blood distribution, gives better evacuation of the bowels, relieves insomnia and raises the general health. In the treatment of local conditions, it causes local hyperemia and removes toxic substances from the seat of injury. Employed as cataphoresis, it introduces medicine into the body. In minor surgery, it is of value as a cauterizing agent for the removal of warts, naevi, etc. The Faradic current acts as a stimulant and the constant current has a sedative effect. Deep seated organs are best treated with the constant currents. From the study of this force, it can be readily seen that it shares the prominent curative features found in all other methods. It directly affects the nerves, which in their turn stimulate organic functioning, frees the blood from toxic substances and brings blood where directed and needed, improves the general blood distribution and by it relieves congestions and pain.

Diathermic—Many investigators noted that in the application of the D'Arsonval current, there was a decided sensation of heat, but for a number of years the importance of this heat was not realized. Professor Nagel-Schmidt of Berlin and Dr. Humphries of London, have been employing the Diathermic current for a long time with gratifying results, and by its means, raising the internal temperature of the body. This is a current of very low voltage, but of an exceedingly high rate of oscillation, and unlike the ordinary current, readily overcomes the surface resistance of the body. It is also not diffused through the tissues, as is the ordinary current, but passes from one electrode to the other. The treatment may thus be localized and it is extensively used for the destruction of both malignant and benign growths. For this purpose a small metal electrode is used, the indifferent electrode being a larger pad. For general application the electrodes are made in such a manner that they may be saturated with a concentrated salt solution and should be kept in close contact with the part being treated.

Diathermic has been successfully used in the treatment of rheumatic joints and affections, and in tuberculosis pulmonalis.

Since 1909 Bergonic employed electric stimulation to produce a general exercise of the muscles of the body. With this stimulation, he caused contraction of muscles one hundred times per minute—it is a passive exercise without fatigue.

The current is derived from an induction coil, or a coarse wire Faradic, whose co-efficient of transformation is two or three, that is, four volts in the primary and eight or twelve volts in the secondary—below the coil are the condensers. The current is rythmically interrupted and reversed by means of a metronome about one hundred times a minute, with the aim to obtain muscular contractions of maximum strength without pain. To accomplish this aim, there must be a perfect regularity of the waves, induced by the wave and break of this current. They must be regular, equal, and synchronous, to be agreeable. If the waves are unequal in form or frequency, they are disagreeable and even unsupportable.

This treatment is especially well adapted to reduce the weight of the obese with a weak heart, who gain in strength and general health without exertion and without tax to that organ when treated with this method. Loss of weight and improvement in general health, which is permanent in character, is noticed from the beginning. The treatment should last from four to six weeks.

ELECTROTHERAPY IN DISEASE

Electrotherapy is hardly of any value in the treatment of the acute infectious diseases, though during convalescence and in the chronic forms, it may be frequently employed with advantage. General Faradization and galvanization, when toning and sedative measures are indicated, as previously pointed out are beneficial. The former improves the appetite, increases muscular tone, evacuates the bowels and improves the general health; the latter acts as a sedative, relieves pain and produces sleep. Neuralgias, muscular and joint affections, following in the wake of the infectious diseases, are frequently best treated with electricity. Faradization of the phrenic nerve has been recommended to stimulate a sluggish respiration. The procedure is as follows: Both electrodes, thoroughly moistened with salt water, are placed on one side of the neck above the clavical 3 C. M. from each other, following the course of the nerve, or the electrodes are placed on either side of the neck in the same position. By opening and closing the circuit, the diaphragm is forced to contract and the movements are increased by an assistant, who at the same time compresses the ribs. From time to time, this procedure has to be interrupted to see if natural breathing has been restored. One

electrode may be placed over the course of the phrenic in the neck and the other over the diaphragm in the epigastrium. The circuit is opened and closed as before. Either method has its advocates and all have given good results.

DISEASES OF THE STOMACH AND INTESTINES.

A number of diseases of the gastro-intestinal apparatus are favorably treated by this method. The application of the current increases peristalsis, secretion and absorption, and the galvanic current acts as a sedative and relieves pain especially cramps, an affection so frequently met with. The chronic diseases of the stomach and intestines and the nervous gastro-intestinal dyspepsias are especially suited for treatment with electrotherapy. Two methods are in use, First: The external percutaneous method consists in the application of two large well covered and moistened electrodes, the one applied to the left of the epigastrium and the other opposite to the back, next to the left of the vertebral column. For treatment of the intestines, both electrodes are placed over the abdomen, one in front and the other over the side, or instead, one may be placed over the back. The current has to be from twenty to fifty M. A. so as to cause vigorous contractions without much pain. Second: The internal application consists of the introduction of a wire electrode enclosed in a stomach tube and ending in the shape of an olive into the stomach, which organ has been previously filled with a salt solution. A similar suitably constructed insulated rectal electrode is introduced into the rectum for the treatment of rectal and intestinal troubles. The other common electrode is placed, in either case, upon the abdomen. Penzoldt advises an electrization of the stomach,—first—percutaneous Faradization—next—galvanization and lastly, the intraventricular method. For the electrization of the intestines, the percutaneous electrization and for the colon the intro-rectal Faradization, or either can be used.

The treatment of constipation with electrotherapy either alone or as adjuvant to some other therapeutic method, has many followers. The external and internal methods have been praised, as also has the employment of the Faradic and the galvanic current. Every therapist uses his special method. For atonic conditions the Faradic current and for spastic conditions the galvanic current are best suited. Occasionally a combination of both, for instance, in nervous cases, may be found of advantage.

The two small well-covered and moistened electrodes may be placed close to each other and moved along the course of the colon, or one electrode, the inactive pole, may be placed on the back and the active pole moved along the same course; or Faradization with one pole electrode in the rectum may be employed instead. Either of these methods often gives satisfactory results.

Hemorrhoids, ulcers and fissures of the rectum may be cured, according to Neiswanger, by copper electrolysis. A copper electrode well covered with moist cotton is placed in contact with the diseased tissue and connected with the positive pole. Five to ten M. A. are used. If the electrode is dipped in 4% solution of cocaine, complete anesthesia is obtained.

It may be mentioned that the electrization of the gallbladder in icterus, between attacks, has been practiced to increase the muscular tone of the organ. Cholelithiasis is most frequently accompanied by chronic constipation and an electric treatment is indicated for that reason in almost all cases and a treatment of the gallbladder at the same time is certainly not contra-indicated and may give good results.

In diseases of the heart and lungs the general and local electrotherapeutic measures that can be occasionally employed with advantage have been sufficiently discussed.

DISEASES OF THE VESSELS—ARTERIOSCLEROSIS

It has been mentioned before that a general arsonvalization has been recommended by Moutier to reduce the high blood pressure in arteriosclerosis, and the results have been confirmed by Gay, who advises the treatment as a prophylactic measure to prevent cerebral hemorrhages. The technic has been fully discussed in the previous pages.

ANEURYSM OF THE AORTA

Electrolysis has been occasionally used with some success in Aneurysm of the Aorta. The technic is simple: Two insulated needles, connected with the poles of the apparatus, are passed with their uncovered points into the sac, not touching each other and the galvanic current is passed across. Coagulation and obliteration of the sac may follow. A second more dangerous proceeding is to introduce a fine gold, silver or steel wire into the sac, through which a galvanic current is passed. Of seventeen cases of thoracic aneurysm treated prior to 1900 only three

were successful. The dangers are embolism, formation of a secondary bulging of the walls of the sac and obliteration of an artery springing from the wall of the aneurysm.

DISEASES OF THE KIDNEYS

Chas. S. Neiswanger speaks very enthusiastically on the treatment of all forms of chronic Bright's disease with electricity. He employs static currents, which traverse the body in every direction along the nerve courses. This causes the nerves to vibrate, each nerve vibrating at a rate peculiar to itself, according to the impulse it has to convey, and as the patient, who sits on the platform of a static machine, is traversed by currents with vibrations from a few to many millions per second, each nerve can choose its own peculiar current and vibrate in a normal way. Only a few currents pass along the nerve from the positive to the negative pole. Many cross and recross and some even pass in the opposite direction.

To substantiate this Neiswanger quotes the case of a patient with diplopia due to injury that partially paralyzed the left internal rectus and who had during treatment his perfect vision restored. He calls static electricity an equalizer that restores a disturbed circulation to the normal. I cannot agree with him as to the character of the persons afflicted with chronic Bright's disease and that they are only, or principally, people who use their brains, for in a large private and hospital practice I have found chronic interstitial nephritis to be the most frequent, though often remote, cause of death in all people and have called attention to this fact in various publications. I believe his explanation that static electricity is an equalizer that restores a disturbed circulation is sufficient to account for the successful treatment of this disease with Franklinization. Nephritis, in all its forms, is a disease of intoxication, affecting every organ in the body, and the circulatory and nervous disturbances are the early and most prominent symptoms. I have treated this affection for years successfully with Arsonvalization, combined with other methods.

Neiswanger gives the history of a number of patients treated by him with Franklinization. Out of twenty he reports twelve permanently relieved, two partially relieved and six failures.

Faradization of the kidney region does not increase urine secretion. Faradization of the bladder by the internal and

external method, that is, one pole in the bladder and the other upon the hypogastrium, or perineum, or both poles applied externally—hypogastrium and perineum—have given results in the treatment of paralysis of this organ and in enuresis nocturna.

In gout, rheumatoid arthritis, in diabetes mellitus and rheumatic affections electricity has been used in its various forms, Faradization, Arsenvalization and galvanization, all have been used occasionally with success and, just as in Bright's disease, I have employed electricity, general or local, as indicated, as an adjuvant to other methods.

NERVOUS DISEASES

In the treatment of the diseases of the nervous system, electricity has been used in all its forms, and ever since its discovery, it has been one of the main methods to treat these conditions. In spite of the opinion of many competent observers, that the success of its employment is very largely due to the effect of suggestion, it has found its advocates and it has kept its high place in the therapy of these diseases.

The exciting and stimulating effects of electricity upon nerves and muscles are well known and unquestioned.

The electrotonus, the effect upon sensation, upon the vasomotor-apparatus and upon secretion, has been studied and if these studies have not yielded very satisfactory results, they cannot be entirely overlooked.

In the treatment with this agent, it is necessary to pass a current of known strength and density through the diseased organ. Dosage and currents have to be selected according to special indications. If the action of a pole is desired, the electrode of the active pole has to be small and must be placed near the diseased organ. The indifferent pole has to be large and at some distance from the former.

Local Faradization is especially used to excite motor nerves and muscles; if the galvanic current is used for this purpose, the cathode is moved along the diseased nerve or muscle, or the cathode placed upon the motor point of the nerve and the current closed or reversed. Less damage can be done with the Faradic current and it is advisable to use it in cases of doubt.

The favorable results obtained by the treatment of electricity in neuritis, myelitis and joint inflammations, glandular tumors, bloody exudations and contusions, and inflammations of bone.

have been explained by R. Remark to be due to the catalytic action of the current, understanding thereby, its electrolytic cataphoretic and vasomotoric effect.

The Electrolytic effect has been observed upon the surface and may affect structures below the skin, at some distance, and medicines have been introduced by cataphoresis and the change in the lumen of vessels, their contraction or dilatation, may be observed at any application. Hyperemia and increase of the volume of a muscle has been seen by R. Remark after galvanization, and increase of temperature after Faradization by Ziemssen.

These are sufficient facts to prove the influence of electricity upon blood and lymph supply beyond question. Erb suggests, to explain the curative effect in so many different affections, with the action upon the trophic nerves. The galvanic current is especially suited to produce catalytic effects.

The various methods of galvanization, Faradization, Franklinization, the employment of high frequency currents and the bath, have been discussed.

TABES DORSALIS

To treat this disease with the galvanic current, the cathode is firmly pressed upon a point of the neck below the angle of the jaw and the anode placed upon the opposite side of the spine next to the vertebra processes and then gradually moved downward. The same procedure is repeated upon the opposite side. This treatment combines the galvanization of the sympathetic and the spine. On account of the limited space in the neck, small electrodes and consequently currents of not more than four to five M. C. can be used; whereas, with the other methods of galvanization of the spine, with a large electrode upon the sternum, larger electrodes and currents of greater strength can be applied. The galvanic current is to be preferred in the treatment of tabes. It has been proven that a part of the current passes through the spine. The treatment of the peripheral nerves is generally combined with the treatment of the spinal lesion by placing a large electrode upon the various parts of the spine, one after another, or upon a plexus, and treating the various nerves with the active electrode. The currents have to be of moderate strength. If the affections are painful, the anode is connected with the active pole. It is thought that the passing currents improve the functional activity of the nerve and the blood distribution around it.

Faradization is used by placing a large electrode upon the sternum and treating the back and extremities with the brush, one after another, to thoroughly redden the places touched. Strength of currents has to vary with the sensibility of the parts treated; however, currents only of moderate strength should be used.

In progressive muscular atrophy and amyotrophic lateral sclerosis, similar methods as indicated in tabes may be employed. Stable galvanization of the spine has been highly recommended. If bulbar muscles are involved and deglutition has become difficult, it has been advised to place a large electrode upon the upper portion of the spine in the back and move a small electrode rapidly down the throat, changing from side to side at short intervals. The treatment has to be repeated from ten to twelve times. The movement with the electrode causes acts of deglutition and usual improvement follows. The subaural galvanization of the sympatheticus has given some results in bulbar paralysis.

The treatment of acute polyomyelitis does not differ. Of course, the electrodes have to be small and the current employed weak in the beginning, not to frighten the children. It is of importance to pass the current through the diseased focus. The electric treatment of the diseased nerves and muscles should not be commenced until several weeks after the onset.

Nothing is to be added to the treatment of the various other affections of the spine. The acute and chronic forms of myelitis and meningitis of syringomyelia of multiple sclerosis, etc., have to be treated on similar lines.

The treatment of affections of the peripheral nerves and of muscles, paralysis and paresis has been previously discussed. For instance—in facial paralysis, stable galvanization of the nerve is acknowledged to be the best method. In these cases, the small cathode should be used upon the nerve trunk and the large anode upon the upper portion of the spine, as the indifferent pole. Weak currents and a gradual increase and decrease of current strength is necessary. The current may be passed across the brain with the electrodes upon the mastoid processes. The paralysis of the muscles has to be treated later with either current as indicated.

Neuralgia has been treated with electricity since the time of its discovery and the treatment of the peripheral nerves and muscles has been a favored field for the electrotherapeutist.

The neuralgia of the sciatic nerve is one of the most common and obstinate forms and a treatment that often yields excellent results has always to be favorably considered. The employment of the galvanic current is preferable.

Edinger places both electrodes near one another, over the lumbar region next to the spine, increases gradually the strength of the current from three to four M. A. and moves the cathode slowly, but firmly, over the leg, keeping the pole over each painful spot from one-half to one minute. He warns not to interrupt the current by removing the electrode from the skin during this procedure and thinks the good results are due to the current passing through the nerve. Duration of treatment—five minutes. He follows this by placing the cathode upon the abdomen or sternum and the large anode over the painful spots, usually the back or thigh. Slow and gradual improvement can be observed in the first few days if the treatment, is effective. He recommends to continue this as long as there is improvement, from four to six weeks are as a rule sufficient, though he does not discontinue it for several weeks, even if in the first few days no marked progress is made. The patient is best placed face downward, and has to rest from twenty to thirty minutes after the treatment.

In the common and severe affections of trigemius neuralgia, the application of the galvanic current has always been considered a supreme remedy. A small electrode connected with the anode and covered with a sponge, is placed upon the painful spot of the nerve and the large cathode between the shoulder blades. The current is turned on and gradually increased to two M. A. and allowed to pass two or three minutes, then gradually decreased and the electrodes removed after the current has been slowly turned off. The treatment has to be repeated daily and continued for weeks. Sometimes the passage of currents across the head will yield results, when the former treatment has failed. Occasionally cures have been affected after weeks of treatment had, apparently, not given any improvement. It is, therefore, advisable not to discontinue this method without a prolonged trial.

Paralysis and paresis due to cerebral affections have to be treated as described. The treatment of the hemiplegia following hemorrhage, must not be commenced until several weeks after the attack and may then be continued for weeks and months. Both currents may be used.

Grave's disease has been successfully treated with electrotherapy. The stabile galvanization of the sympathetic nerve has

been highly recommended. The cathode is placed upon the neck between the angle of the jaw and the inner border of the sterno cleido mastoid, and the large anode is placed upon the back of the neck between the fifth and seventh cervical vertebrae. The galvanic current is turned on, its strength gradually increased to two or three M. A. and allowed two to three minutes to pass, then gradually decreased and turned off. This treatment has to be continued for weeks and months. Oppenheim and others report good results from it.

Vigoroux recommends Faradization with the large anode between the shoulder blades, small cathode upon the sympathetic, duration one and a half minute, with a current strong enough to contract the sterno cleido mastoid. Next application of cathode upon the points around the eye and finally a large cathode is placed upon the bugulum, the thyroid gland and the heart. Duration from ten to twelve minutes. This treatment is employed every second day and continued for a long time. The current passing through the gland has to be strong, and weak when the electrode is placed upon the heart. The employment of Franklinization and of high frequency has given good results in the hands of many observers, also in my own.

The treatment of neuroses has been discussed.

Though the opinions as to the curative effect and value of electrotherapeutic methods differ very much, it is proven that all affect the nerves, sensory, secretory, motor and trophic; that skillfully applied, they regulate organic functioning, purify the blood, improve blood-distribution and bring a purer blood and a larger supply to diseased structures.

As stated before, electricity furnishes us valuable means to treat disease and fully deserves the place it has taken in the armamentarium of the physician, to relieve suffering and cure disease.

TREATMENT WITH ROENTGEN RAYS.

The rays resemble light in so far as they travel in a straight line, affect photographic films, excite fluorescence and are not deflected by a magnet. They differ, however, from it, as they cannot be refracted and polarized, they are invisible and pass through substances which light cannot penetrate. During the passage of the rays through metals, as a portion of the rays is absorbed, the greater the density of the metal, the greater the absorption of the rays. (Figure 10).

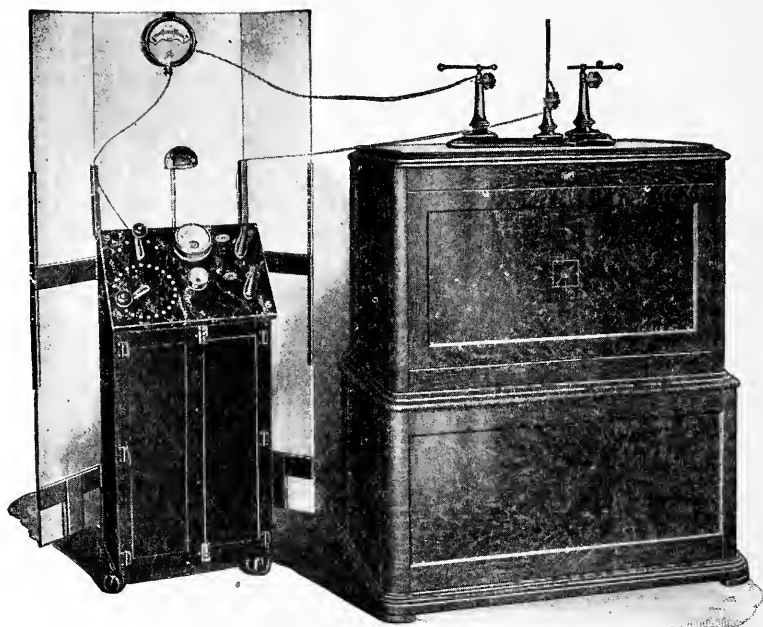


Figure 10—Enclosed Type Snook Apparatus

The same law holds good for tissues of the human body. Glasses and air are practically transparent to X-Rays.

A number of discoveries preceded and paved the way for Roentgen's great work.

Faraday introduced the vacuum tube and discovered the cathode rays, given off by the cathode, when a current is passed through the tube. Great advancement was made in the study of these rays, before Roentgen, experimenting upon them, discovered the X-Rays, which are found when a metal plate interrupts the cathode stream. Rays are produced and radiated that pass through opaque substances and are absorbed in their passage through such substances in direct proportion to their density. They affect photographic films, and due to their peculiar properties allow skiagraphs, photographs of bones and organs of the human body, to be taken. (Figure 11).

Another invention is the Crookes tube, which was used by Roentgen in his original work and has been modified to bring the cathode rays to a focus by a target made of metal that allows the strongest currents to pass for two minutes, sufficient time for the most difficult skiagraphic work.

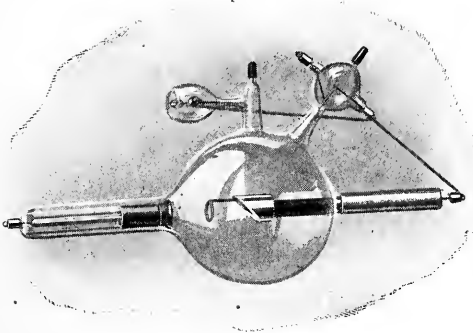


Figure 11—X-ray Tube

If a Crookes tube is gradually exhausted of its contents of air, the distance between the molecules is increased, friction lessened and wave lengths of the passing current increased. As the exhaustion is carried on more and more, the molecules are split up into atoms and finally into corpuscles, and parts of atoms, the smallest parts of matter. This is shown by the appearance of the current that changes from the noisy well-known zig-zag spark, into one of deep purple passing silently through the tube, and when the stage of molecular division is reached, instead of the spark, a bluish glow fills the tube, again changing into a greenish or yellowish diffuse light, that illuminates the tube, as atoms are divided into corpuscles. The tube is then brought to a state of exhaustion to give clear pictures upon a fluoroscopic screen and then sealed.

Continued use of such a tube causes still further exhaustion by uniting the corpuscles with the anode and cathode. When the tube is too hard and useless for work, it no longer gives the skiagraph. A number of ingenious methods have been devised by manufacturers to soften a hard tube, that is, to set the corpuscles free again, so that such a tube, if carefully handled, can be used for a long time, before it has to be re-exhausted. Even a rest after use for some time will soften a tube and this is always advisable to save costly material.

Currents obtained from the Static machine or induction coil are used to produce the rays. It is advisable to select an apparatus that gives a spark length of from forty to fifty C. M., a good interruptor and a tube of medium hardness. Duration of exposure varies according to the affection to be treated, though some operators prefer small and repeated doses, and other longer exposures.

The distance of the tube from the place to be exposed should be about forty C. M., sufficient to avoid an electrical and heat effect. The enclosure of the tube in a lead box, the use of a lead diaphragm of lead foils and screens is necessary to protect the patient and operator. The eyes may be protected with spectacles made of leadglass. Every portion of the body should be protected, except the part to be experimented upon.

With instruments to measure the hardness of the tube, quantitative, the intensity of the rays and a milliamperemeter to measure the electricity that passes the tube, exact doses of Roentgen rays can be administered.

The effect of the rays upon micro-organisms, vegetable and animal is slight, and some observers, after careful experiments deny a bactericidal action altogether, though others claim to have obtained it, not enough, however, to use this agent for such a purpose. Ferments are not influenced by exposure to the rays. If small animals are exposed, the lymphatics, the spleen, the thymus, testicles and the bone marrow show various changes. The blood of rabbits and dogs, shows a destruction of white cells.

Metabolism is influenced, and the amount of excretion changed, depending upon the destruction of leucocytes and nitrogen, elimination is increased, followed by a period of retention. The growth of young animals is interfered with, whereas the nervous system and the other organs are but little influenced, though the brain seems to suffer after exposure.

Changes in man after exposure to Roentgen rays have been found to be similar to those found in animals. Histological examinations of spleen, lymphatics and organs have been made on individuals dying from leukaemia or other diseases and on that account are not of great value.

ROENTGEN THERAPY IN SPECIAL DISEASES

The range of its usefulness as a therapeutic agent in disease is not great; yet, it has to be considered as a valuable adjuvant in the treatment of disease. It is probably more used at present in the treatment of malignant growths of every description than in any other disease, not because its employment has given excellent results, but because it has yielded the same or perhaps better results than any other method, with the exception of Surgery. Surgery, however, does not cure, but merely cuts out the growth with complete success, that is, without return in only a few

cases, not more than 10%. But it is for this effect that surgery, in some cases the only remedy for malignant growths, has to be considered first.*

There are epitheliomas, however, where treatment with the Roentgen rays may be of equal value; but, even in these cases, a surgeon should be consulted.

There then remains only superficial growths and deep cancers for treatment with X-Rays, in which either the patient himself after due caution or the surgeon, has refused an operation. It has been proven that treatment after operation to prevent a recurrence, is indicated in every case, to have a destructive effect upon the cancer cells. The results are altogether poor, but as has been mentioned, equal and perhaps better than those obtained with any other method except surgery. The curative influence upon spindlecell and roundcell sarcomas is somewhat better. Pains are much lessened, general health is improved, the growth diminished in size and cures of even deep-seated sarcomas have been reported.

The treatment of leukaemia introduced by Senn of Chicago, has given good results in some cases, especially in myelotic leukaemias, though it is claimed that the lymphatic form and the pseudoleukaemia are improved as well. A cure, however, has never been effected in any case. The disease is progressive and in spite of this treatment ends fatally in from one to three years.

The treatment of tuberculosis affections of bones and joints has been successful in some cases.

Graves' disease has been treated with varying success. The results are far from being encouraging, however, the method has its advocates. In the treatment of certain diseases of the skin, especially herpes and favus, electricity has given good results and an X-Ray apparatus for treatment of these affections as well as for the treatment of Epitheliomas is found today in the office of every skin specialist.

Roentgen rays have a destructive influence upon morbid cell growths and their therapeutic effect seems to be especially due to this fact, though relief of pain and general improvement follow the treatment.

* The general faith in surgery still remains, in spite of the reports made by Bulkeley & Seeley-Little of their success with the Medicinal Treatment of Cancer.

RADIUM

H. Becquerel discovered in 1896 that the phosphorescing rays of uranium compounds affected photographic films just as do the Roentgen rays, passing through paper not passible to the light rays and later that all uranium compounds, with or without phosphorescence, possessed the same properties as Uranium.

The Curies, working in their laboratory, following up this discovery, isolated from pitchblende, the source of Uranium, Bismuth, 0.3% of this mineral gives one hundred times greater Radioactivity than uranium. Finally by employing crystallization, they discovered a new element they named Radium. Its atomic weight is two hundred and twenty-six. If brought near a charged electroscope, it causes its discharge—Radium compounds develop heat and are luminous. They emanate different kinds of rays, which act upon vegetable and animal organisms, similar to the Roentgen rays.

The effect of Radium upon malignant growths is slight. All that is known of Radiumtherapy at present does not materially differ from Roentgentherapy and the explanation as to the action of the radium rays is the same as in the Roentgenology.

Radium has been introduced for treatment in forms of capsules, at the bottom of which is spread a uniform layer of from five to ten M. G. positive Radiumbromide. The capsule is made of hard rubber or copper foil with a thin aluminum bottom. It is placed for a few minutes upon the point to be treated, or moved to and fro, which latter method has been highly recommended by Wetterer. Diseases of the skin and small epitheliomas have been treated successfully by this method.

Jeff Miller in treating inoperable cases of cancer of the cervix-uteri with Radium, finds that it stops bleeding and pain, and is a powerful deodorizer. "Ten days after radium applications, the odor commences to disappear, temperature, if present, subsides, and the foul discharge stops."

All his cases have been benefitted by the treatment and a few have remained free from recurrence. After observation from May, 1914, to November, 1915, Kelly and Burnam report fifty-seven clinical cures; thirty-five cases of original inoperable cancer of the cervix-uteri and vagina, and eighteen cases of vaginal recurrent cancer. One cure has lasted six years; three, over four years; four, over three years; five, over two years; twenty-nine, over one year, and fifteen, over six months.

Roentgen and Radium rays destroy malignant cells and cause an inflammatory reaction. If the dosage is not sufficient to destroy all cancer cells, but sufficient to destroy some and injure others, the injury will act as a powerful stimulus for rapid growth and proliferation of malignant cells. The inflammation set up by the rays brings ample nutrient material for growth and the danger of metastatic processes is enormously increased. The rays have no selective properties for cancer cells; they destroy and injure special tissue cells, if the dose is sufficiently strong.

Cancer cells are affected according to their resisting power. The cells of sarcoma are less resistant than carcinoma cells. If tissue cells are completely destroyed, scar tissue takes their place.

In 1900 Doro discovered Radiumemanation, a gas charged with positive electricity, constantly produced from radium and iron salts radioactive and inducing radioactivity in other substances. The gas is invisible in daylight, luminous in darkness, has electric properties and can be kept in glass vessels, does not react chemically, and changes after a while into Helium. The emanation is soluble in water and is present in almost all natural mineral waters. It has been artificially produced and therapeutically used in forms of the bath and for internal use.

Both forms have given results in the treatment of gout and rheumatic affections. Their effect upon treatment leave no doubt that they, like the other methods, effect organic functioning, purify the blood and influence its distribution.

CHAPTER VIII

PSYCHOTHERAPY

Psychotherapy relies solely on the "vis medicatrix naturae." Though one of the most important of our methods of treatment, it is but little understood by the general practitioner and has fallen largely into the hands of the quack. It is practiced often unconsciously, rarely, and by but a few with a purpose.

If a patient suffering from an acute or chronic affection is assured that he will recover and "*believes it*"—"has faith", he is in the best position to assist Nature in her efforts to cure. The higher centers are in abeyance, and cannot interfere with the lower centers that sustain life and protect the organism.

Circulation and respiration are carried on with an uninterrupted regularity; vessels contract and dilate to send waves of blood where needed, slowed and retained in diseased structures, due to the injury to vessels; organs function well, and "strengthened and stimulated by hope, quieted and soothed by absence of fear and morbid apprehensions", toxic products are neutralized, pathogenic micro-organisms are destroyed, and waste eliminated.

The purified blood flows in large quantities to the seat of disease to effect a cure. Pain stops, sleep is promoted, appetite returns and the patients recover.

Unfortunately there are many instances where Nature is not equal to the task, and where in her efforts to cure she does too much or too little, and the patient may succumb. When the system is invaded by disease, no one can tell what the outcome will be, and it is reckless and criminal to deceive the sick and allow them to fight their battle without the aid of scientific medicine. Who dares to treat diphtheria without antitoxin, syphilis without mercury, arsenic and the iodides, malaria without quinine, or who does not reduce a hyperpyrexia and subdue an excessive intestinal fermentation, support a tottering heart, or prevent a threatening collapse with stimulation? Who treats a uremic attack with suggestion; who does not open an abscess or treat purulent appendicitis without operation? No practitioner would leave an infected wound unattended, or fail to protect his patient with an injection of antitetanus serum when indicated. Who can talk to a

delirious patient of faith cures? Faith alone must fail. Functional diseases have an organic basis often not recognized and all need treatment. Habit and occupation are often the cause of organic disease and have to be modified, or changed, diets prescribed and hygienic measures taken to cure the patient. The family may have to be protected and the spread of infections prevented by suitable means. A physician does not use one method alone, but uses them all for one purpose—to purify the blood and to send it where needed—psychotherapy is one and not the least valuable. It enters every treatment and according to Bernheim, if suggestion is not everything, there is suggestion in everything.

The mind presides over every function of the body, and over every process of life. Mind is brain activity. It is the living brain. Without brain there is no mind. There is not a single cell the life of which does not depend on nerve force; not a disease that is not influenced by the mind. The function of every organ depends on the integrity of the complex nervous apparatus. The mental phenomena, intellectual, emotional and volitional, closely connected with each other, may be traced to the lowest form of life. The cells of the body select their food from the blood; according to their needs, they inhale and exhale, grow, work and die. A liver cell manufactures bile and glycogen; an epithelial cell of the kidney tubules, separates waste; the ciliated epithelium of the capillary bronchi prevents foreign substances from entering the alveoli by a constant outward brushing movement and a brain cell receives impressions, preserves them and sends forth motor impulses. Thompson says: "that the amoeba presents active and spontaneous movements and here one not only meets with a power of choice, but also an intelligent consciousness in selecting food."

Romanes says—"No man can have watched the movements of certain infusoria, without feeling it difficult to believe that these little animals are not actuated by some amount of intelligence. There is a rotifer whose body is of a cup shape provided with a very active tail, armed with strong forceps. I have seen a small specimen of this rotifer attach itself to a much larger one with its forceps, the larger rotifer at once becoming very active and springing about with its burden till it came to a piece of weed. It took firm hold of the weed with its own forceps, and began a most extraordinary series of movements to rid itself of the encumbrance. It dashed from side to side in all directions, but no less

surprising was the tenacity with which the smaller rotifer retained its hold, although one might think it was being almost jerked to pieces. This lasted several minutes, until eventually the small rotifer was thrown violently away. It then returned to the conflict, but did not succeed a second time in establishing its hold. The entire scene was as like intelligent action on the part of both animals as could well be imagined. So that if we were to depend on appearance alone, this one observation would be sufficient to induce one to impute conscious determination to these micro-organisms."

Williams Dawson speaks as follows:

"An ameba shows volition, appetite and passion. One trying to swallow a one celled plant as long as its own body, evidently hungry and eager to devour it, stretched itself to its full length trying to envelop the plant. It failed again and again, but repeated the attempt until at length, convinced of its hopelessness, it flung itself away and made off in search of something more manageable."

There is not a single living being which, whether it knows it or not, in so far as it lives and moves and keeps up its being, exhibits the fundamental quality of reason. Instinct means organic experience, while reason is instinct in the making, an instinctive creature is a creature formed with functions, without further nerve structure to undergo further formation, hence, is not capable of progress.

The intelligence, the habits and instincts of the ant, the bees, and other insects is well known and has been summed up by Lindsay: Co-operation for a given purpose, division of labor, working by turns and relief parties, obedience to authority, including language of command. Understanding a language (often a touch) organization of ranks and military discipline; knowledge of possession of power and use of it, subjection of the weak by the strong, judicial punishment of disobedience or rebellion, forethought real or apparent; practice of agriculture, harvest and storage, respect for an interment of dead, mourning, or its resemblance in bereavement; funeral ceremonies, including processions; use of natural tools, instruments and weapons; passions of rage and anger; imagination and its derangements by hypnotism.

Maudsley says: "There is not a single mental quality which man possesses, even to his moral feelings, that we do not find its germ more or less fully displayed in animals. Memory, atten-

tion, apprehension, foresight of ends, courage, anger, distress, envy, revenge and love of kind"—and the sense of direction is intensely and far higher developed than in man. He reports an instance of animal intelligence highly interesting—of the elephants in the Lao State of Northern Siam, engaged in timber work. "Elephants actually feed the circular saw in the mill, and so marvelous is their intelligence that an astute little tusker was observed to cease the pressure on his log, withdraw it anxiously, and then offer another part to the revolving saw, which was formerly going crookedly through the log."

"It sounds strange to say that these elephants are very human, but it conveys exactly what we mean. We are assured that at the sound of the dinner bell, the saw-mill elephants will instantly drop their logs and scamper off screaming with glee at the welcome respite. They will refuse absolutely to tackle a log which they consider too heavy, but if the mahout insists, they may possibly call some of their mates to lend a hand."

"The stacking of the logs is wonderful to witness: An elephant has brought this log near the stack and is picking up one to place it on the top. He finds he has not brought it near enough, however, like the skilled laborer he is, he requires no orders from the foreman above him. He calculates the distance with the eye—he walks around the end of the log, applies his trunk and tusks thereto, and gives a mighty push. Once more he goes back and judges the distance. 'Just right'—he next places one end of his log on the stack and then goes to the other end on the ground. This, too, is lifted and the whole log pushed home triumphantly. A heavy trailing chain is sometimes fixed to the elephants that are turned loose to feed in the jungle at night, in order that wanderers may be traced by the trail left by the chain in the jungle. Well, it has been known that when an elephant has made up his mind to bolt, he has carefully gathered up his tale chain and carried it for miles on his tusks."

The almost human intelligence of dogs and horses with whom we are in daily contact, hardly needs mentioning. Some twenty years back I had to cross the Llanos Estacados. I was riding a pet pony of mine, was scantily provided with food, and had but a canteen filled with water, being assured that I would find several camps on my way. It was in July and the weather very hot, no dew. Provisions and water gave out the first night, and no camp or water hole in sight. The second night I was too weak and exhausted to take the saddle from my horse and to

stake it. I just rolled out the saddle to sleep. Next morning, I found my horse grazing but a few steps from me. I managed to mount it and reached the head of Concho River at noon, where I found a cow camp. Arriving in San Angelo, I was taken with a continuous fever, lasting several months, probably typhoid, the diagnosis was not made. If my horse had followed its instinct, it would have left me and found water in a few hours. If it was not for its loyalty my bones would be bleaching on the prairies of Texas.

The minds of animals differ in degree only from that of man and not in kind, and there seems to be but little difference between that of an Australian negro and a highly developed Chimpanzee, in fact, there seems to be less, than there is between the savant, who benefits the world with his gifts and a two-legged brute. Mind depends on the quantity and quality of the brain, without it there is no mind. There are no two brains alike and the brain of the infant differs from that of the adult. In the new born child, the brain is almost smooth; it is more watery, and its cells and fibres are far less in number than in the adult brain. As life advances and with the use of the brain, cells and fibres increase in number, convolutions deepen and the organ becomes firmer to reach its maximum in adult life. When the infant is born he is the product of heredity. Past generations have formed him, a link in an endless chain. Mind and body are impressed with the characteristic features of the race, from which he springs, and of the nation and family, of which he is a member. His brain is thickly sown with tendencies and disposition ready to react to stimulation for good or evil; nerve paths are ready for impulses to travel, and centers to receive impressions and to become instincts and habits at once, of virtue or vice, whatever, that may be, whereas, others are merely dimly outlined and ample material is present for new pathways to form. The heart beats in the mother's womb, stimulated by the circulating blood; the lungs commence to breathe as soon as the air passes into the bronchi, and the digestive organs act when the newly born babe is taken to the breast. They are reflex actions due to brain activity, having their seat in the lowest centers, located in the medulla, connected and influenced, however, by all, to the highest cortical centers. The pulse is accelerated and slowed, respiration increased or decreased and digestion promoted or depressed by emotion, and all are more or less influenced by the will. They are automatic functions of brain activity that commence with life, acting

with almost mechanical regularity, never to stop until life ceases. They are common to all, life depends on them. They vary with each individual, just as the organs, which they stimulate to action, differ. There is probably not a single cell of one organism exactly like the corresponding cell of another. Idiot or imbecile, average or genius; all is determined at birth, depending on quantity and quality of brain, called forth to act, modified and changed by environment.

Man is the product of heredity and environment and the cells of his body and brain do not act, but react to stimulation. All actions, more or less, are reflex acts. The afferent impulse may be discovered in every act, may it be called reflex or voluntary. We are conscious of voluntary actions, subconscious or unconscious of reflex acts and it is probable that all reflex actions have been voluntary in the beginning and have become reflex acts by practice in the life-time of the individual or his ancestors, transmitted to the descendants. Every voluntary conscious-act, is more or less laborious and fatiguing. With practice it becomes less difficult, gradually sinks into subconsciousness and finally is unconsciously performed. The nerve path is marked, sensory and motor impulse follow the path of least resistance. A habit is established and if transmitted to the descendant, it is called an instinct. Walking, speaking, the play of musical instruments and most actions of everyday occupation have become automatic. We leave the house or office, walk along the accustomed road, the mind occupied with various subjects and arrive at our place of destination, surprised to have reached it. The skilled musician plays his instrument unconscious of the intricate movements his fingers execute, and the man who speaks a foreign language is barely conscious of the first word. The practiced surgeon after opening the abdomen, puts his hands to the right spot, without thought, and the skilled diagnostician, sees with his finger tips, feels with his eye and discovers often instantaneously pathological conditions a beginner will not find after laborious work.

The brain is the seat of sensation, volition and intellect. Volition is the beginning of motion and feeling; but a word for consciousness or attention of a sensory impression. In the cortex are located the highest centers of brain activity; the basal ganglia are the seat of reflex actions and instinct, relieving the work of the cortex. The corpus striatum is the seat of motion; the optic thalami that of sensation, and especially of sight. The cerebellum is the great center for the co-ordination of muscular move-

ments, the harmonious adjustment of the working of the muscles which maintain the body in a position of equilibrium; and in the medulla are located the important centers that sustain life, respiration and circulation. The spinal column presides over reflex acts. If a frog is decapitated and his side is touched with acid, he will scratch the spot, and if the limb is amputated he will make attempts to reach it with the stump; failing in this, he will after a few moments of restlessness reach over with the sound leg to scratch, (Pfleuger"). If thrown into water he will swim. If placed on a slating board, he will crawl up and if stroked on the side he will croak, (Goltz). Man can control some pure reflex acts by the will, showing their close connections with the cortex. Coughing and sneezing may be suppressed and the body kept quiet when a surgeon probes a wound. Cranmer being burned at the stake, held his hand in the fire until it was consumed and Mucius Scaevola, to show the invading barbarians of what material the defenders of Rome were made, did the same.

After the spinal column is divided by injury or disease, reflexes are no longer controlled and modified by the brain and their excitability is increased below the division. The study of reflex in man is of high importance in the diagnosis of nervous diseases. Disease or injury to any portion of the reflex arc abolishes it. Voluntary acts pass into reflex acts, and it can be understood that spinal centers through which the impulses constantly travel from and to the brain, may under certain conditions, learn to perform functions usually belonging to cortical centers.

Kirk compares the nervous system to an army. The highest center, the commander in chief, gives an order for the movement of a body of troops to his generals, to be compared with the principal motor-centers of the cortex, sending out an impulse for the movement of arm or leg to subordinate officers, with directions how to execute the movement and through them it reaches the men, who move in harmony with their fellows. The subsidiary nerve centers or positions of relay, enable the impulse to be widely distributed by collaterals to numerous muscles, which contract in an orderly, harmonious and co-ordinate manner, and just as a private in the army communicates with his general through several subordinate officers so the sensory impulse passes through many cell stations or subsidiary centers on the way to the highest center where the mental process called sensation, that is appreciation of the impulse, takes place. The localization of brain centers

has been studied, and though far from being perfect, it has been conclusively proven that the cortex contains the highest cerebral centers and that the basal ganglia are subsidiary to these higher centers.

Extirpation, stimulation and comparison of clinical symptoms with post-mortem finding, have placed the motorcenters in the convolutions around the fissure of Rolando and sensory centers in their vicinity. The center of vision is located in the occipital lobe and the angle of gyrus. The localization of hearing, taste, smell and tactile centers is not yet absolutely certain, though it may be taken for granted, that sensation and volition are closely connected and that the fibers of sensations connect with the beginning of the motorfibers. The motor center of speech is located in the third frontal convolution and its sensory center in the first temporal convolution.

Irritation causes movement, and extirpation paralysis. A paralysis on one side of the body with muscular atrophy of the extremities on the paralyzed side, may be caused by an embolus in the arteria fossae, Sylvian, by a hemorrhage into the internal capsule, or by thrombosis due to arteriosclerosis, or lues, causing softening on the opposite side of the brain.

Disturbances of speech and paralysis of cranial nerves frequently allow an exact localization of the seat of injury, to guide the surgeon in cases where an operation is indicated. Paresis, with destructive process in the cortex, causes insanity, so does arterio-sclerosis and other pathologic processes that cause changes in the brain substance, or intoxications that produce similar alterations, sometimes so minute, as not to be visible under the microscope, if the patient dies, due to some intercurrent disease.

The most simple mental process is a sensation. To produce it, a stimulus, a nerve ending, a path to the brain and a sensory center are necessary. The brain learns by experience to refer the sensation to the seat of stimulation, that is to the stimulated nerve endings. The pain caused by a blow or cut, is referred to the bruise or wound, and after amputation, pain is still felt in fingers and toes, by an irritation of the nerve in the stump, due to the established habit. All our knowledge is made up of such sensations received by special senses. It is seen, heard, felt, tasted or smelt, more or less deeply impressed upon the nerve centers, depending on quantity and quality of the brain, on the intensity of the stimulation and on the repetition of the process. These impressions, if deep enough, are indestructible and lasting and may be

remembered many years after they have been made. They are engravings made with indelible ink and form a part of the personality. They are the principles of thought, conscience and character, and may be received consciously, or unconsciously. We may work in our room, intensely occupied, and do not hear the clock strike, but long after, we become suddenly aware that we have heard it; or we may walk along the street pass our best friend and not see him, to recollect later that we have passed him. This is sufficient proof that the mind registers impressions that will influence our actions in later life, when we are not aware of it. The impressions are made by molecular waves passing from the place of stimulation along the nerve path to the center, and a collection of these impressions, past and present, is the mind. Every impulse that travels along the nerve path leaves its trace. It develops heat, causes changes in the molecular arrangement of the cell and affects the circulation. The flow of blood is necessary to produce these. The brain changes with advancing years, cells and fibres increase in numbers, formed by impulses passing through the neuroglia. Mental development means physical change. One depends on the other. Every psychical act is accompanied by physical and chemical changes, which are visible in the nerve cells if the stimulation has been excessive. Metabolism increases and temperature rises, when the mind is active. From the outside world and from within, from organs and tissues, numberless impressions are constantly received, deposited and stored away by the brain, changing its configuration. As the brain is, so is the mind and parenchymatous tissue once destroyed cannot be remade.

Simple sensory impressions are the elements of perception. They combine in groups, firmly linked together and form entities that are perceived. Every object we recognize is a perception, from an orange or apple, made up of color, form, taste, smell and all its other qualities to the more complex one, tree, house, man and so on. Grouping, linking and associating of perceptions form conception. We recognize an apple, or an orange to be a fruit and to belong to the vegetable kingdom, or a dog to belong to the animal kingdom. Once perceptions and conceptions are formed, and are printed upon the brain cells, they are lasting and permanent, constantly received consciously and unconsciously, strengthened by repetition, modified by new stimuli or fading. Just as preceptions are the elements of conception, so are these the elements of complex ideas. Grouping, associating and discrimin-

ating of conceptions is reasoning. This depends on quantity and quality of the brain of which they are a part; on the environment that has made them and furnishes the stimulation that prompts the reasoning, influenced by the state of the whole organism. Simple impressions, perceptions and conceptions are deposited in the cells of the cortex, gradually to be referred to lower centers, basal ganglia or spinal centers, as is evidenced by experiments in man and animals. They are then said to be subconscious and unconscious. We are not conscious of them, though they may rise at any time unconsciously, or by the efforts of the will into consciousness, stimulated by impulses that have produced them originally, or by association. The cortex presides over all. Clouston says—"we talk, laugh and weep, we blush and shiver, we hunger and sweat, we digest and defecate, all through the brain cortex. There is not one of the physiological acts that can not be instantly corrected by a mental act." That is, acts that have become habits and instinct by constant repetition, and are based upon heredity, even those that carry on and sustain life are still influenced by the cortex. It presides over every function; and absorption, secretion and excretion, vascular tone, circulatory changes and metabolism all are regulated by cortical action.

A lesion due to cerebral hemorrhage, embolism or softening, will cause atrophy and paralysis of muscles, disturbed sensation and temperature changes on the opposite side. Lower centers that have become in the course of time the seat of these functions, are still presided over by the cortex and cannot continue to work without its influence. By destruction or stimulation of cortical centers, we can cause either paralysis or muscular movements of certain muscles or groups of muscles, or cause loss of visual memory, of speech, of hearing, etc. All the knowledge we possess is obtained through the special senses. A child born blind and deaf cannot have visual or auditory sensations, and if impressions were not allowed to enter, he would not possess any knowledge at all. The cells of the body and brain do not act; they re-act. A sensory impulse travelling to center makes an impression and is followed by muscular movement. If we hear a sound, we turn the head toward it, and the result of our deliberations is action in word or deed, a complex of muscular movements. Excessive stimulation causes pain and may lead to unconsciousness, no matter whether the stimulation is mechanical, like a blow causing a wound, chemical like a drug producing pain and

unconsciousness or thermic. Pain is conveyed by special nerves. Memory is dependent on the integrity of the cortex. A destruction of the speech center causes aphasia and that of sight, loss of visual memory. Impressions made upon the various centers of special sensation can be recollected only when the cortex is intact, and what is true for these counts for all others.

Impulses received at the periphery pass through lower centers before they reach the cortex, and a similar path has to be travelled over by impulses sent from center to periphery.

The sympathetic is in intimate relation with the central nervous system, with its large number of glands along both sides of the spinal cord, its plexuses of ganglia distributed in the thoracic and abdominal cavities, and those scattered in the heart, in the gastro intestinal tract, the walls of the arteries, etc., receive their stimulation through the central nervous system and carry on vaso-motor, secretory and excretory process with almost mechanical regularity. The important processes that sustain life, respiration, circulation and digestion are completely guided by them, presided over by medulla and cortex and our sensations of bodily welfare and distress are due to their activity. They are the functions that commence to act at birth. Other functions, for instance, the sucking movement of the lips of the new-born as soon as touched, the clasping of the fingers around any object that is put into the hand and many other acts, are all reflex acts inherited, that is pathway and center, ready to react to the special stimuli. Occasionally, when organic functions are disturbed, we become conscious of them, though of some we are never conscious. Pupil reflex and a few other manifestations we cannot control. They are known as automatic acts, the result of instinct and habit. New reflexes are added as the child grows, such as winking and sneezing, etc., and at the age of fourteen years, all are present which we find in the adult should be present. These reflexes based upon inherited pathways form the stock with which the child commences his work in life. He receives at first a medley of impressions setting free a large number of in-co-ordinate movements. An organization of these is the formation of habit. The deeper the path cut from periphery to center and from center to periphery, the more firmly is the habit established, so that it finally becomes reflex. This explains why a musician may play without being conscious of the movements of the fingers. Generally we are conscious of objects and not of sensations. Through the association of a number of sensations received by the special senses, we know an

object and see it as past experience has taught us it should be. When we see an orange we see it with all its qualities. A fine piece of steel, we see as a needle and we know at once it has a point and a head, and its use is for sewing, etc. A piece of polished marble gives us the feeling of smoothness and coldness, etc. Illusions are, therefore, frequent. The correct reading of misprinted words is common. We hear our name called, when in fact the sound thus interpreted may be due to any possible noise that has stimulated the auditory nerve. We see, hear, taste and feel with the impressions that have been stored away, associated with the object. On this account the danger of false testimony produced by illusions is very great, and especially so in children.

A lawyer in a Western country town had to defend a man who killed another in a shooting scrape. The men were hunting each other all over the place. The State introduced several witnesses that swore on the stand they had seen the defendant fire the shot and identified a toy pistol, filled with cologne, which the lawyer held in his hand, declaring it to be the weapon that the defendant had used.

Recently, a man was killed in my neighborhood by a trolley car. Several witnesses swore that the conductor had not stopped at the corner. The conductor rebutted this testimony by the statement of sixteen witnesses, two of whom had alighted at that very place.

An illusion is an erroneous perception. A hallucination, a perception of something that is not physically present, this is far more rare. A man imagines he still has an arm or leg that has been amputated long since, or sees a person that is miles away, or hears somebody talking to him who is not present. It has been said that hallucinations are extreme cases of illusions, misinterpretation of sensory impulses due to a disturbed local circulation, or congestion in the ear or eye. We are conscious of illusions and hallucinations. We perceive objects as we have observed them to be, by association and dis-association, synthetic and analytical processes. Consciousness is a quality of the mind, not the mind itself. It is neutral activity concentrated upon one particular spot of the cortex. Consciousness is not inherited—it is acquired. It is not present for days after birth and very vague for weeks. Not until impressions of sensations and perceptions have accumulated does consciousness become clearer. The perception, the last and new one, is more strongly felt than the rest. It is attended to and we are conscious of it. *Attention*

and consciousness are synonyms. "Consciousness always has a focal point, which reveals the momentary activity of the mind." It has been compared with the spectrum, the visible rays gradually passing into ultra red and the ultra violet rays; with the visual field clearest at the sensitive spot of the retina, gradually fading towards the margin, and with a stone thrown into still water, which causes the highest ripples where it has dropped, becoming less and less marked as they pass on. Consciousness is never stationary; it is always shifting. It may be active or passive, voluntary or involuntary. Infants are not capable of voluntary attention. Involuntary attention is spontaneous. It is a response to sensory stimulation, with preference to the most intense, or to objects that produce pleasure, persons and animals and things generally that excite emotions. Voluntary attention is selective, a product of association and experience. It is a derivative of spontaneous attention, opposing a tendency of division, and there is no difference whether attention is fixed upon things external or upon ideas, the mind can never attend to but one thing fully. An injury may be received in a crowd. The mind being occupied, we do not feel pain until we see the blood flow or discover the bruise on undressing. The abstracted student does not hear the clock strike in his room—and so on. Attention is followed invariably by muscular movements, whether it is sensory, responding to external stimulation idiational, or a response to internal stimulation caused by changes in the cerebral circulation. The glass of wine that produces a flood of ideas or the dose of bromide that empties the cortical capillaries and causes sleep, illustrate this.

In sensory attention the sensory motor circuit causes conversion of the eyes to obtain the best vision. A sound turns the head. To taste anything we have to bring it in contact with the tongue, to smell we have to inhale and to feel we have to touch the object. The body or the extremities may be moved in response to ideas originating in the cortical centers and the muscles of the face have been called the muscles of the mind. Habits of thought are expressed upon face and body. We recognize good and bad people by the expressions of their faces and by their gestures. We recognize occupations by the same means. The lawyer, the doctor and the clergyman, the sharp trader, or the crook, and the simple mechanic, or the laborer are recognized with the same intuitive perceptions. It has been suggested that sensory impulses produced by muscular movements sent back to

the cortex, modify and change, affect especially the muscles of the face, throat and chest, often changing the character of breathing. In fact we hold our breath to see and to hear better. Consciousness is the most important factor in the formation of new habits and in the adaptation of the organism to our environments. It is caused by cortical stimulation and does not essentially differ from any other mental act.

Memory, the faculty of the mind to recollect past experiences and events, depends entirely on the retentiveness of the brain. Every impression made upon it during life, has changed and modified it, and though a large number of impressions on account of disuse, or being less deeply engraved than others, will gradually become faint, all will more or less influence our actions in life, as tendencies and dispositions. We have seen that the various impressions, as they are received by way of the special senses, are stored away in certain cortical areas, the destruction of which obliterates the memory of these engravings. Certain cortical lesions will prevent the individual from recollecting visual or auditory images, others, those of taste and smell or will cause partial or complete amnesia. In old age, when due to the progressive and general decay, memory fails, it does so according to certain laws. Recent events are sooner forgotten than past, due to tissue change, lessening its capacity to retain. The memory of current names is lost early, and the more concrete the ideas, the sooner the loss of remembrance of them. The deeper the impressions of images, the more closely connected with others, the more lasting the memory. The early impressions of childhood, or of religion, no matter what that may have been, the words of the mother's tongue and the scenes of home, are lasting. All this proves the physical basis of memory.

An image impressed upon the brain cells depends on their sensitiveness to receive it, on the intensity of the stimulation or its repetition and on the concentration of attention. It differs, therefore, widely with individuals and some are abnormally sensitive to certain stimulants. The mathematical and musical prodigies are well known. One cannot recollect names, another cannot memorize figures and another, again, cannot recollect faces, though, if the stimulation has been intense and accompanied by great emotion, as for example, the escape from a burning house or from drowning, or the scene of battle, are all vividly and in detail recollected as long as life lasts. Some recollect better things that they have seen; others, those that they have heard. Some

learn quickly and forget as fast as they learn, and others learn slowly and retain what they have been taught. All this and various other features of memory depend, other things equal, on the quantity and quality of the cortical center or centers involved. To memorize well, we have to make a deep impression and associate it with as many other impressions, as possible, to affect a larger area. Concentration of attention and repetition will accomplish it. Immediate practical use of the new experience by writing or talking about it, or using it in some mechanical way, will best serve this purpose, as it gives natural outlet for motor impulses that invariably follow sensory stimulation. A stimulus that has produced the original impression or one that is similar to it, external or internal, will reproduce the image so that we again become conscious of it. The more vivid and acute, the deeper the impression was made, originally. We recognize at the same time that it represents a part of past experience, an incident in our former life. Memory depends upon association, upon habits formed, and we recall a past event by associating it with events that are connected with it. We have often to go slow and proceed step by step to recollect fully something we have experienced at some former time.

Memory is a quality of the mind early acquired. An infant soon remembers the face of its mother, the taste of food and various objects, due to re-excitation of pathways over which previously the same or similar impulses have travelled, and of centers upon which previously the same or similar processes with which memory commences, accompanied by movements, that become co-ordinated and form habit, which sink into the subconscious and unconscious. Such habits formed, guide us unconsciously in life and with them we respond to the constant stimulation of the environment. It is thus that we can perform the numberless and very complicated acts of an every day routine life automatically, without tax to the cortex.

Recollection and recognition of ideas does not differ from that of perception, except as regards stimulation, which in these cases is internal, caused by changes in the capillary circulation. Though conscious recognition is something that cannot be further analyzed, it is entirely dependent upon the accompanying act that produces it.

There exists some important difference between memory and imagination, though they have much in common with each other, and both are based upon the registration of perceptions upon the

cortical centers. There are as many kinds of images as there are special senses, of which the visual and auditory are more readily and more accurately reproduced by most persons. Memory is re-productive imagination, or representation; that is a simple recollection of a past event. Imagination proper, or as it is called, productive imagination, combines past experiences, sensations and perceptions that have been stored away, in the most manifold and fanciful ways. It creates something new out of old material. It is thus that genius has produced the great works of art, that have elevated mankind and that have been the joy of generations past and present, and it is by the same means that inventions are made that mark the progress of the time. Dreams that frighten and that please are but a new combination of familiar facts, characterized by dissociation. It is not in human power to create something entirely new, as frequently thought, but, as has been stated, new creations are combinations of stored away material. The law of association of ideas governs imagination, that is, the more often one idea has been associated with another, the greater will be the probability for it to appear with the first in consciousness. The impulse travels the path of least resistance. It selects the most deeply cut of all others that lead from one cortical area to another, when the first is stimulated, depending upon the established habit. This is illustrated by everyday experience. Grief will produce thoughts of sorrow, and joy only those of pleasure. This is further influenced by the intensity, frequency and recency of the association. Anything that has made a deep impression can be recalled vividly with accuracy of every detail. When we think of the Panama Canal, Gorgas and his sanitary measures that made the work possible, will vividly be recollected and if we think of tuberculosis, we recall Koch's bacillus. A porter who was working for a friend of mine, used to bring home-made cakes every year shortly before Christmas. He quit and went to work in a drug-store, where my wife saw him for several years without recognizing him. He came recently to the house and noticing him through the window, she sent the house-girl to receive the cake. On being informed that he was sent by the druggist, she remembered to have seen him there many times. Ideas follow one another because they have something in common. A total stranger may suggest an absent friend, or a foreign country, the familiar scenes of home. There is nothing essentially different in imagination and memory from any other brain activity. They are based upon previous perceptions and

allow us to use past experience in the present and for the future. They are diminished by disuse and age, not inherited, but acquired and increased by practice.

Perceptions linked to one another form conceptions and when attended to, that is, when appearing in consciousness, convey meaning. The first vague identification of one experience with a previous one in the consciousness of the infant, represents the beginning of this brain activity. It is a recognition of likeness and difference of the whole and its component parts with a previous experience, an apprehension of relations following the conception producing it, a part of consciousness. Conceptions form chains and systems, ideas constantly modified, constantly changed by the environment and by the state of the organism itself in health and disease. Ideas are things real, just as the sensations, perceptions and conceptions of which they are composed and, like these, they are a part of the personality and determine its destiny. They represent images, visual, auditory, motor, etc., and they convey meaning. We employ them all and different ones on different occasions, thinking about the same event, to-day visual and to-morrow perhaps largely auditory. Language corresponds to images, words are motor expressions of sensory impulses and serve as perceptions and conceptions to the hearer. Words—a table, a horse, a dog, etc., are images. The material of which language is made up are the sounds that are instinctively produced by fear, anger, joy and other emotions, invariably accompanied by gestures. We can observe this in animals and in the infant, who expresses his disgust or approval, his fright, or his anger, his pleasure or his wants, in this way, and it is not until he has reached the age of eighteen months, or even later, that he has a sufficient stock of words for this purpose. The method by which language has been developed is that of imitation. These sounds are imitated to indicate to others the condition which produce them. The language of gestures does not differ in character from verbal language and the deaf mutes depend upon it entirely. Conceptions commence to form in early infant life, develop and change with the need of the individual as it advances in years and our educational systems try to provide for future needs.

Numbers are only of use after some property rights have been developed and so we find little of them in the language of the savage. When in Central America, I found the Indians only able to count as far as ten, and there are tribes living in the

Murray Islands, in the Straits of Torres, that can count only as far as two. On the other hand, in certain mines of Hainault, the horses are so used to traverse the same road thirty times, that after their last round they go to the stable of their own accord, and refuse to take another step. We read in Montaigne, that the oxen used in the Royal Gardens of Susa for turning the wheels to which water pails are attached refused to make more than one hundred rounds, which constituted their daily task. Mancini has definitely established the fact that magpies and rooks cannot count farther than four. A rook never returns to its nest unless it is quite satisfied that there is no danger near. It was proved that when four hunters, or a lesser number, who had been in a cabin departed in succession, a rook would return to its nest only after the last had gone out of sight. But, whenever they were more than four, the bird lost count and returned to its nest even while some were still in the hut. Similarly we are assured by Jacquet that apes do not count further than four, and that the Boers of the Transvaal, when they go to hunt these animals, hide in numbers exceeding four. Four depart in succession in such a manner as to be noticed by the apes, who then come forth and are easily captured. This illustrates that the use of numbers and counting is developed with need in man and animals alike.

The first vague conceptions of infancy form the root of all others; one is derived from the other and all are related to one another. New conceptions contain new stimuli upon the same centers, some old material and modifications of old conceptions appear as new ones. A conception is a rudimentary judgment. It is reasoning with the increase in numbers and richness of conceptions; judgment develops. It involves all the fundamental activities of the brain; sensation, perception, memory, imagination and conception.

Knowledge is like a tree that springs from a seed, or like the human organism itself with its myriads of cells all closely connected and depending on one another for development and growth, and all springing from the fertilized ovum, in which are imbedded the potentialities of the future. If a child is told that something it does is bad and is punished for it, it soon will remember the consequences of such actions—cause and effect are connected and judgment commences. Though with advancing years, this is modified, the original remains and with the assistance of language, the child will learn to apply the term bad to all acts of a certain character. Judgment essentially appears as stimulation.

external or internal causing perception and this in its turn, reacts with judgment. Judgment does not add to the stock of knowledge we possess. It is based upon it and brings order. It is a process of pulling apart and putting together, a process of analysis and synthesis, and a series of judgments constitutes reasoning. It assists the organism to adapt itself to changing environment and develops with need. It commences early in the life of the infant and depends on the demand made upon the child by its environment. It gradually becomes more complex. If we want to purchase a picture, without having made up our mind beforehand what it shall be, we find at once a large number of conceptions; judgments rise into consciousness by association. The subject of the one may remind us of our home and another of scenes that have impressed us in former days. The beauty and coloring, the price and many more influences govern our final action. Gradually and deliberately or quickly—almost immediately—a decision is made as one or the other of the ideas gain the upper hand over all others. If we have to reason often upon the same and similar subjects, the process becomes habitual, the impulses travel along beaten paths and the decision is quick, intuitive, practically a reflex action, disturbed when new conditions are confronted. If the situation is difficult and life is in danger, people become panic stricken, all co-ordination of muscular movements is lost, frantic movements are made, resembling those of infancy before co-ordination is established and not rarely leads to a way of safety. It is Nature's last resort to protect the organism from danger and adapt itself to new and dangerous conditions. We reason largely with general principles acquired by induction and deduction. Learning by experience that a certain thing happens many times, we conclude that it always does so. It is an immutable truth that all men must die—stealing is wrong, etc. These principles are so firmly impressed that we use them as it were by reflex. They are mental habits. A large number of gross errors are due to such general principles not well supported. As stated, reason depends upon other mental activities, sensation, perception, conception, memory, imagination and association of ideas and on the quantity and quality of the brain at each particular time and the number and richness of conceptions. They have been called halfway stations between stimuli and reactions, which permit us to summon movements from past experience adapted to a new surrounding. Every conscious mental act may or may not be accompanied by feeling. Two such

feelings are known, one of pleasure and one of displeasure, rising occasionally to a sensation, almost of pain. It is important in many instances to make a difference between pain and discomfort, frequently confounded by patients who describe their ailments. Severe pain means a serious local trouble, whereas, discomfort, no matter how severely felt, has not such a significance. The patient finds it often difficult to make an analysis, and it takes careful and skilled questioning by the physician to find out what he means by pain. Just as pain is a protective measure, so are the feelings that from extremes may pass gradually one into the other and be entirely neutral. They aid the motor responses that the organism has constantly to make to suit itself to the ever changing environment; they are a part of consciousness, commence and develop with it and tend to make us continue or discontinue an act. Impression of sound and color, taste and smell, may affect us pleasurable or cause discomfort, and the same impression may produce either feelings or affections at different times. Acquired tastes are first disagreeably felt and cause a great deal of pleasure later on, and a large number of sensations do not affect us at all. Ideas affect us as sensations do, and feelings are never experienced except as companions of either. Pain when severe, is always accompanied by a sensation of discomfort and displeasure, though when slight it may affect some people at least pleasurable. It acts, therefore, like all the other sensations in this respect. It increases with prolonged stimulation, gradually decreases and after a while may not be felt at all, due to exhaustion or adaption. Intensity has a similar effect and slight stimulation is but little felt whereas strong stimulants usually cause displeasure. This effect is materially changed by the state of the organism and sensations that, causing pleasure to-day may cause discomfort to-morrow. They are thought due to numberless stimulants, constantly received from the internal organs of circulation, respiration and digestion, and as has been stated before, they are protective and prompt us to continue or discontinue an act, and whatever aids us in our present occupation is agreeably felt, and whatever obstructs, causes disagreeable sensations. So may memory and thought affect us and cause pleasure and discomfort as they promote or obstruct our present interests. Affections are forms of organic sensations and as they accompany activities, useful or harmful to the organism they cause pleasure or discomfort, determining the whole mental state. It is, therefore, that a sensation is agreeably felt at one time when at another it may become

unbearable, due perhaps to a torpid liver, and for the same reason, the agreeable and disagreeable effect of excessive or moderate stimulation finds its explanation. They lead at once to motor-reaction, advance or retreat, and have been called mental attitudes. They act similarly as pain does, which when due to injury, forces us to discontinue the occupation, whereas the affections indicate danger more remote or inform us of our well-being. Pleasure stimulates. It heightens vital activity. Pain and discomfort depress. Metabolism, respiration and circulation, secretion and excretion all are influenced by affections and it has been demonstrated that pleasure dilates the peripheral vessels, slows the heart-beats and increases the depth of breathing, and that discomfort has the opposite effect. As our daily life is routine in character and most actions are automatically performed, consciousness is but little required and it is, therefore, that acute pleasure and displeasure is not more frequently felt. At the root of every affection and of every emotion is a mental representation.

Affections commence in early infancy. When a new born baby is hungry, it becomes conscious of this disagreeable sensation. It cries and struggles. This act is the release of motor impulses that have not yet made way for regular movements adapted to this condition. These are the first acts of consciousness. As stated, some motor co-ordination commences with life itself, inherited always for motor impulses. The action of all the vital organs, the reflexes involved in sucking, crying, etc., are sufficient to sustain life. Development of co-ordinated movements is very rapid. In the beginning, during the first few weeks, the eyes move independently from one another. Gradually they commence to converge and follow a moving object. At this time the hand commences to explore, things are grasped and moved about, the eyes following the movements; a conjoint co-ordination of hand and eyes, characteristic of all development of control of muscular movements. At the end of three years the child is practically in possession of all the reflexes of the adult, with the exception of the sexual. A reflex act is a motor response to a sensory stimulation of which we are only rarely conscious. The pathways are inherited. Sneezing and coughing appear early, next winking, etc. As time progresses these phenomena become firmer and more securely established with practice. All serve the organism to adapt itself to the environment and increase its efficiency.

Instincts do not essentially differ from reflex acts and no line of demarcation can be drawn. They also depend upon inherited pathways, though reflex acts are mostly unconscious, instincts always involve consciousness. They pass into one another, and little reflexes are modified by the stimuli. If the execution of an instinct causes pleasure and satisfaction, it will be repeated, and soon form a firmly established habit. If on the other hand, it causes displeasure, it may be temporarily or entirely suppressed. Instincts appear like reflexes with the development of the nervous system and represent the experience of the race. They are racial habits. Even in the lower animals, they are influenced and modified by individual experience caused by the changing environment that demands such modifications. They have been established consciously, unconsciously, or partly consciously to protect the individual against surrounding dangers and may have become so firmly fixed, that they continue, occasionally, long after they have become useless.

Anger and fear—half instinct, half emotion—with their corresponding motor expressions, are found in very young babies, and are no doubt, inherited, formed for protection, useful at some time in the life of the race, though at the present, it is often impossible to trace the utility, these motor-reactions may have once possessed. Fear, anger, shyness, curiosity, sociability, sympathy, affection, sexual love, jealousy, envy, revelry, play imitation, constructiveness, secretiveness and acquisitiveness, are the human instincts generally accepted. Walking and talking are added by some writers. Most of these forms of instincts show the characteristic features of emotions, conscious feeling, whereas in another form, the act is prominent.

Fear is normally caused in children by something unknown and strange; in adults, by something that suggests danger, frequently out of all proportion to the situation and entirely unreasonable. It may root the individual to the ground and cause violent trembling. The feeling is certainly not useful, but even under present conditions, it serves often as a warning of imminent danger. Anger is aroused by a large number of causes and finds varied expressions developed in the constant struggle for existence. Shyness and sociability can be observed from early infancy throughout life, the one bordering on fear, the other on love and affection. Their attitudes are well known. Secretiveness appears as a form of shyness. Curiosity is well displayed in the life of the child, but more or less accompanies us to old age and often we

have to follow the impulse against better reason. Originally it is interest and serves a good purpose. Acquisitiveness commences with the reaching out for and keeping of anything that the infant can lay his hands on, to the collection of the boy and the earnings and savings of the adult, all of the most varied character, but all obeying the inherited instincts of the race. Rivalry and competition developed in the struggle for existence pass easily into anger, hate, jealousy and envy, and though civilization, ashamed of the brutality of this instinct, has, to some extent, stopped the bloody and cruel combat amongst individuals, it still considers it correct practice between nations, and the assistance of the Almighty is evoked to help slay the enemy, burn his houses and devastate his fields, just as was done in the barbaric ages. The object has changed, however. Scheming Hierarchy used to influence the masses with religious fanaticism, whereas at present, greed for commercial gain furnishes the cause. But just as in former days, the Lord is asked to take a hand in the game and thanked with burning of incense and ringing of church bells by the victor, and as it used to be in the past, in struggles between individuals, bankruptcy and starvation has become the fate of the victims of competition in the present age.

It cannot be said that civilization has made any advance in this respect, nor that religion has ever aided such a human cause. Slavery used to be the fate of the conquered, extermination has been the fate of the converted races. Religion always has aided and does side to-day with authority, an observation to progress, an instrument of subjection by those in power. The most devout are the kings "by the grace of God—and of money." Patriotism is used like religion to incite the masses and set man against man by the greedy, rich and powerful.

Jealousy and envy are frequently the consequences of rivalry and often pass into anger and hatred. They are found in little children and no one can doubt that they are inherited instincts developed in the past life of the race. The sexual instinct, undoubtedly the most powerful of all, accompanied by organic changes, is necessary to keep the race and so is parental love and especially the love of the mother for the child necessary to protect the infant and to sustain and to aid him during the first year of life. Play is work for the child and calls forth a number of voluntary muscular actions preparing and training it for the struggle of existence. Play usually imitates somebody or something observed and passes into constructiveness, only a feature of play

and imitation. This can be seen in the very young, and their inherited and useful character cannot be doubted. The instincts are impulsive in character, that is, they are executed on the spur of the moment without reflection, though we are aware of them, or become conscious of them during the act. Their strength depends on the cause that provokes them and they vary in different individuals. When they make their first appearance they are unknown to the individual and recognized only by experience. The first spell of anger that overtakes the child and the first infatuation of youth illustrate their features well enough. Emotions form a part of the instincts. They accompany instinctive acts and resemble feelings that accompany conscious, subconscious and unconscious acts. They are referred to the cause, the terrifying object that throws us into a paroxysm of fear, or the event that provokes a storm of anger. Setting free a number of inco-ordinate muscular movements, respiration, circulation and digestion all are more or less affected and in their turn cause the emotion. In abject fear, we become speechless and rooted to the ground, with palpitating heart and rapid respiration, the mouth becomes dry and perspiration may pour out from the forehead. In a fit of anger, things are smashed generally. It is thought that emotions depend on sensory motor activities going on in the body, affecting and modifying consciousness. The emotional stimuli are followed by definite motor reactions, in which the whole cortex shares, molecular waves radiate in every direction. The stimulation is excessive, creating new situations to cope with; motor impulses cannot drain off in accustomed channels and the obstruction causes the pent-up impulses to pass off in a paroxysm of inco-ordinate movements, partly to involuntary and partly to voluntary muscles giving rise to emotion and restoring the equilibrium. Emotions vary in intensity and quality with the nature of the cause. They are inherited and have been gradually developed in the life of the race. They are due to a number of reactions, all of which at least at some former time have been useful, called forth by various objects, all at one time, and the consciousness of the conflict that ensues before any one gains the upper hand, characterises the emotion. The motor re-actions relieve the tension that precedes and so far as they may not be useful under present conditions, they certainly have been so in the ancestral life. Predispositions for certain emotions are called moods when transitory, and temperaments when permanent. We speak of sanguine and phlegmatic temperaments, etc. Characteristics of individuals and senti-

ments, friendship, love, enmity, etc., characterize habits of cultivated thought. Man is the product of inheritance and environment and it can be readily understood that the action of his whole mind is his will. His control over muscular movements is designed to adapt him to his environment. Sensations, perceptions and ideas, impulses, affections and emotions, memory and imagination, judgment and reasoning, all acting, make up his will. All influence his acts and determine his movements. He is conscious of a small focus and dimly notices ideas as they appear in the margin of his consciousness linked and associated with the vast store of impressions made upon his brain during his life. Of these he is totally unconscious, depending partly on inherited tendencies and dispositions and partly on the environment in which he has grown up. "Lucky is he who has inherited a sound brain and has it stored with rich material, who can fix and keep his attention upon any subject he has under consideration, can bring a large and varied knowledge to bear upon it, see correctly and make a prompt decision."

The training of the will is a training of all the faculties of the mind and any method that does not recognize it must completely fail. All of the important decisions are made by the adult with the use of such habits automatically, writing, reading, walking, talking and in fact there it not an act that cannot finally be traced to acquired habits. They form a part for good or evil and we can observe daily how futile it often is to replace bad habits with good habits, the only means to counteract them. Yet when we see hungry, half-starved and half-clad people tramping the streets of a large city on cold winter days, the ground covered with snow and sleet, and not a ray of sunlight to brighten their plight, and see them pass shops and stands richly filled with a tempting display of goods, without even attempting to steal, then we can appreciate what training has done to make these people suffer the tortures of hell over and over again, in spite of their instincts of self-preservation. This instinctive action of imitation, conscious and unconscious, is one of the most powerful incentives to produce these habits. The sounds made by the mother are imitated by the baby. The child tries to duplicate his elders, the schoolboy imitates his comrades and the adult his associates, and it has not been rarely observed that husband and wife resemble each other in word, act and in appearance after years of married life. How fortunate are these that grow up in favorable surroundings and how unfortunate are those for whom the reverse

is true! Early impressions are lasting and it is most difficult to substitute stronger healthy habits, even after a change of environment is made. Training of the mind goes on forever as long as life lasts and it may be stated that those advanced in years, though not as productive as the young and the middle aged, have been sought to counsel since time immemorial on account of vast experience, knowledge stored away, a gift to be acquired only with years. If it must be taken for granted that some do not keep up with the times, it is also true that many of the young remain useless during life. That this advantage of the aged is recognized, notwithstanding the tendency of the times, may be seen from the fact that the retiring age of the Judges of the Supreme Court of the United States is seventy-five or as much longer as they are able to hold this position of importance and responsibility. Though we are impressed with the freedom of our will, it can be readily seen that choice depends not alone on selective attention due to tendencies and predispositions for certain objects and occupations inherited, but as well on the state and composition of the brain at each particular moment when such a choice is made. Each voluntary act takes place in consequence of heredity and personal history of the individual. There are not two persons that will re-act in exactly the same way to the same stimulus.

Mind and body, or the body endowed with an active nervous system is the self. It is born, it grows and decays. It is an entity. We are aware of its existence through consciousness that connects in a continuous chain, interrupted by sleep through memory, past, present and future. "The self is an indubitable part to us; it is our life with its ambitions, its miseries and its joys; it is our conscience and our character."

The mind is common property of man and animals and the brain of the higher developed animals possesses the basis for the appearance of consciousness and reason.

If the evolution of the mind and its functions are understood, it can be readily seen why psychotherapy is such a powerful agent in the treatment of disease, and if a number of practitioners still smile, when they hear about suggestion, and the aid it affords in the treatment of the sick, and make light of the cures it has affected, it proves that they are not familiar with the method and that they do not appreciate the significance the mind has in health and disease. All organs, including the sexual organs, make blood, keep it pure, and distribute it, and the cortex presides over all. We have seen that voluntary acts originate in the cortex and

as they gradually become habit they are transferred to the lower centers to be transmitted to the descendants as instincts when they are firmly established. This process can be continually observed and the chances are that reflex acts are developed in a similar fashion. The fact remains that they all are connected to the higher centers and that the cortical centers for the cranial nerves are manifest. In psychotherapy, we use the stimulants that have produced them, and their impressions upon the cortex to reach the lower centers for the sole purpose of purifying the blood and bringing it where needed. As far as this is concerned, psychotherapy does not differ from any other therapeutic methods and it is immaterial whether the effect is produced by a cold water application, by the electric current or the rays of radium; by a simple rest in the recumbent posture, by drugs or by suggestion. In either case, cortical centers are stimulated and motor impulses are sent out to affect the organs and through them the composition and distribution of the blood. Mental action regulates the functions of life in health and is an important factor in every disease and no action of the mind can take place without some physical alteration of structure. Sensory impulses and motor impulses, as they travel to and from centers, leave their permanent traces and functional disturbances reveal organic disease. The cortex is the great regulator of all organic functions, and every disease causes cortical changes through the impulses sent from the diseased organs to the centers. A purely mental disease does not exist. It is preceded or accompanied by cortical changes, even if we do not recognize them upon examination. Sensory impulses are followed by motor impulses and so it comes that we can read the story on the face of our patients, or pick out the doomed as we walk leisurely along the street. Continued disturbance of mental function causes structural changes of organs and there is not a disease known that has not been caused in this way, or the course of which has not been influenced by it. Mental strain is a more frequent cause of arterial, kidney and heart disease than is generally admitted, though it is known that physicians die from it more frequently than saloonkeepers. It keeps the arteries contracted and on a tension to furnish the brain with blood and forces heart and kidneys to overwork. Emotions, fright and anger have caused and cause numerous cases of epilepsy, collapse and death, due to the sudden and severe disturbance of the circulation. Functional diseases do not exist. The name merely indicates ignorance and, as mentioned before, I have found in all cases of

hysteria and neurasthenia, splanchnoptosis, the cause of the palpitating heart, the asthma, the contracted vessels, the cold extremities, the chills, the varied and numberless pains, digestive and mental disturbances—all due to the serious disturbance of the circulation in this condition.

Mind does not exist apart from the brain, and every organic function is due to brain activity, depending on its quantity and quality, the product of inheritance and environment. If a pain is felt, it is real, no matter whether the irritation of the center is due to injury at the periphery or is central, produced by impure blood, or a disturbed capillary circulation. With suggestion we can stop and cause pain by regulating this state of mind. Pure blood and a perfect circulation means harmonious functioning of all organs. It means good health. All methods now in use must be aided by psychotherapy to increase their efficiency. A drug will not be absorbed and a meal will not be digested, if the physician himself is not agreeable to the patient, or bad news has upset him. Cheerful company and hope for recovery are good tonics, and I know of one instance, at least, where the physician "who could not lie" has hastened the death of the patient and of many where a bad prognosis has made the patient miserable for the rest of his days. The physician is called to cure and if that is impossible, to prolong life, soothe and relieve. Besides, with all diagnostic skill and intricate methods, we yet make mistakes and no man can tell in any given case how much resisting power a patient possesses, how much parenchymatous tissue is left in an organ, capable of reconstruction. We must fight disease to the very last. Expectancy leads onward to recovery and protects in danger, or may cause disease as observed in any epidemic. All this is due to the influence of the mind over the bodily functions and blood distribution. The cold sweat, the palor and the tremor of fear illustrate this. Expectancy strengthens or depresses the resisting power of the organism. This explains why the confidence of the patient is such an important factor and why some physicians will obtain results with the same treatment that has failed in the hands of others. No physician should treat a patient unless he has his complete confidence secured. We have to adapt ourselves to patients and surroundings, as one differs from the other, just as we adapt ourselves to new situations. This can be done successfully only by fixed habits. An effort to that effect will be noticed by the patient. Some are born physicians and this inheritance favors them. We have seen that all the impressions received at any one time pro-

duce their effect upon the cortex, even if we are not conscious of their action. Consciousness is only a part of mental activity linked with innumerable threads to the unconscious. It is attention and constantly changes, clearing and organizing ideas that rise from the unconscious. It modifies old and forms new habits. It is a small fraction of mental activity and does not differ from any other and appears when established habits cannot cope with new situations. The best work is automatically performed; consciousness interferes with established habits. We are often unable to spell a word that we have used hundreds of times or execute a simple act when consciousness meddles with the process. It helps in new situations and hinders in familiar acts. It is linked to and controlled by knowledge, habits stored away in the unconscious, that continue to work even in our dream life. Only a small portion of this activity enters consciousness, though it modifies past expressions and not rarely influences us during the day, a fact of which we are not always aware. The greater part of our knowledge is beyond consciousness, where mental activity is constantly at work, called forth by suitable stimulation to appear in consciousness. The mind constantly arranges and re-arranges perceptions and conceptions, breaking them down and building them up, consciously and unconsciously. Sometimes when we listen to the strains of music, or lie down to sleep, we find a train of ideas rising into the margin of consciousness. They rise from the long ago or continue the thoughts that have occupied us during the day, preventing sleep against our will. This process continues during sleep in dreams, occasionally remembered, always influencing our actions. Many times we rise depressed or cheerful, unable to account for either state of mind. Blood is necessary for work and during the night, when external stimulation almost ceases, impulses are sent from organs and the blood itself stimulates the centers. Ideas precede action and it does not matter whether or not we are conscious of them. When feelings move and emotions stir, consciousness enters but little in our acts and it is in these states of mind that religious converts are made, that the audience is swayed by the orator and actor, and the mob follows the leader to commit a crime. Unconscious mental activity influences every organ in the body, every physical and mental act. The impulses are efferent and the movements produced, correspond to the intensity of the mental process.

Special nerves and nerve tracts convey special stimulants and sensory impulse to center, and motor impulse to periphery, con-

stituting every physical act. Man does not act, but reacts to stimuli. Every stimulation, central or peripheral, physical or psychical, is followed by a motor-reaction and the nature of the reaction is determined by the nature of the brain.

Psychotherapy uses suggestion as means to stimulate cortical centers to reach and act upon the lower centers that control organic functions.

Suggestion may be divided into persuasion, suggestion in the waking condition and hypnosis. Suggestibility is a normal characteristic of every normal brain and Bernheim defines suggestion "every process by which a perception is introduced and accepted by the brain."

Suggestion plays a very important part in life, though it is rarely recognized. We receive and accept constantly suggestion from our environment, and education and training are synonyms of it. We believe what we are told to believe, do what we are told to do, and imitate what we see others do. The press moulds public opinion, and the clergy religious beliefs. There is not a single act in our lives that is not influenced by suggestion, and every impression received through the special senses is a suggestion. When using it for therapeutic purposes, we have to make a strong impression upon the mind and this is frequently better secured by reasoning and persuasion, instead of by authoritative statement addressed to credulity, which is usually taken as a pure suggestion. Reasoning with the patient often secures better attention, increasing the efficiency of the measure. We may be left, however, under the impression that the desired effect has been secured by reasoning, when on close scrutiny we find that after all, suggestion has been at work. Both blend into one another and it is often difficult to decide whether suggestion or reasoning has been the effective cause.

Hypnosis is in some cases preferable, as it secures the fixed attention needed, which occasionally cannot be produced in any other way. Hypnosis resembles sleep, and sleeping persons can be often influenced by suggestion, and hypnosis can be converted into ordinary sleep. In sleep, the condition of the mind is altered, a general dissociation is its characteristic feature, and this is the characteristic of hypnosis. A sleeping person reacts to stimulants, groans and stops snoring when requested, answers to questions and by remembering dreams we know we have slept. The lighter the sleep, the more it resembles waking. Feelings are exaggerated in dreams, perceptions and conceptions are loosely connected

and faultily associated, simulating real occurrences. Anemia, a slowed cerebral circulation and a retraction of the "dendrites of the cells" (cells have a different appearance in rest and activity) are thought to be the physical basis of sleep, due to the accumulation of waste in the blood and to a racial habit to instinctive action. Usually the most fantastic nonsense is dreamed, though occasionally, problems are worked out in dreams and remembered. In sleep, the brain is relatively inactive, repairing damage sustained during the day. The blood current is slowed, favoring this process.

Hallucination, dissociation, exaggerated feeling and partial or complete amnesia, are characteristics of hypnosis and of dream-life, and time is accurately measured in sleep and hypnosis. Everybody dreams and is frequently able to, at least, recollect a portion of his dream. An external stimulus rarely calls forth an exactly corresponding perception. Rattling of the window may cause the sleeper to dream of burglars entering the house, etc. Light sleep and light hypnosis differ less from the waking condition. In both, a patient may perceive everything that goes on and declare that he did not sleep at all. The mechanism of sleep does not differ from that of hypnosis. Suggestion produces both. Fatigue favors sleep and exhaustion may prevent it. Hypnosis, like the normal sleep, varies from a mere drowsiness to a deep sleep. Due to the slowed circulation, only some of the centers are stimulated, and active respiration and circulation keep up. Fixed attention and an obedience to stimulation are the essentials of hypnosis; the nature of the stimulation is of no importance.

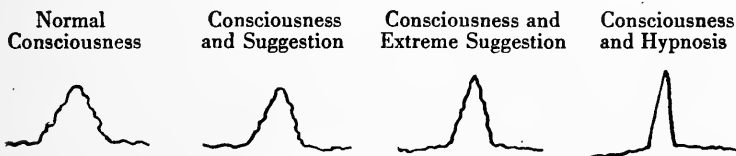
A normal person is more alive to a particular class of excitants. He is pre-occupied and may be absolutely blind and deaf to all others. Insensibility to pain of wounds received in battle, the "absent mindedness" of the scholars, etc., are notable examples. In the hypnotic state the subject is non-sensitive, except to certain objects, persons or ideas. A person in a natural sleep exhibits slight differences of excitability towards the objects of his environment. He is, however, more easily awakened by the sound of his name. A professional man is more susceptible to his professional stimuli. An exhausted waiter wakes up to the whispered call of "Waiter" and the slightest wail of the infant wakens the mother. A slight stimulation is effective under these conditions, due to the firmly established habit, the deeply cut path. The mind is awake as it were to such stimuli.

The criminal and the immoral cannot resist the slightest temptation. The path is ready for the impulse to travel, predominant to all others, many of which may be normal, etc. A hypnotized person exhibits inequality of excitability carried to the extreme. The prescribed stimulation acts while all others are without effect. He feels, hears and sees only what the hypnotist wishes him to see, or to feel, yet we know that the stimuli produce their usual effect. This is due to a narrowed consciousness to fixed attention, just as in the waking condition, though more pronounced. The hypnotized acts in obedience to suggested ideas. Most of our acts are automatically performed; those of the hypnotized all are and are purely automatic.

A bread pill given with the assurance that it is a purgative will likely produce purging, and an injection of water will produce sleep, if the patient is told that he has received an injection of morphine. Suggestion can counteract and increase the effect of any drug. Nothing succeeds like success, and expectation of failure frequently causes failure and the confidence of the leader gives confidence to his men.

Hypnosis embraces all the phenomena of suggestion and a suggestion given in this condition stands out with sharp and crude distinction in the brain, dissociated from all others, depending on attention.

Starbuck gives a graphic picture of consciousness in the normal condition and under the influence of suggestion and hypnosis.



Three states are generally recognized.

The light drowsiness or somnolence in which the person can resist the feeling and open his eyes.

The light sleep, in which the person is unable to open his eyes and obliged to obey some of the suggestions, and deep sleep or somnambulism, with the phenomena of catalepsy, anaesthesia and amnesia. In some subjects this state can be produced in the wak-

ing condition. All are produced by suggestion, the operator remaining in rapport with the subject. If anybody suggests something to himself or persuades himself of something, it is called auto-suggestion. The effect is that of suggestion. In either case a partial or complete dissociation of ideas is produced and the person acts in obedience to the suggestion. It may be accepted subconsciously or unconsciously, and yet, act powerfully, the person being unable to remember and does not know that his acts are prompted by suggestion in such a case. Everybody is more or less auto-suggestive, and expectation renders auto-suggestion more acute and preconceived ideas increase its effect.

Telepathy—thought transference—has not been proved, though it would find a ready and natural explanation if it could be done. It has been aptly compared with wireless telegraphy. We feel the stare of a person, who may be walking or sitting behind us, and on entering a dark room, we become conscious of the presence of a person, even if we do not hear the sound of breathing. Monroe in his work on suggestive therapeutics, reports a very interesting instance. He hypnotized a young man, whom he had frequently treated, blindfolded him and wrote upon a piece of paper. "Go to the mantelpiece and get the baby's photograph". He then removed the bandage, told him to open his eyes and do what was ordered on the piece of paper. The young man went at once to the mantelpiece, put his hands upon the photograph nearest to him, which was the wrong one, but put that down, then went to another, which he also put down, and lastly took the indicated photograph, held it in his hand and turning around with a blank expression on his face, handed it to him. Similar experiments were repeated with the same success by the same authority. This and similar phenomena could be readily explained as thought transference.

There is another condition to be considered in connection with hypnosis—double consciousness or double and multiple and altered personality. At times another identity than the one with which we are familiar take possession of us, and we commit acts in this state that surprise us and our friends. We have not been ourselves. This peculiar feature is especially marked in the artist, who frequently shows his double personality to everyone that comes in contact with him, though more or less it is common to all. Men often show an entirely different character at home from the one known to their business friends, in some instances, both pass apparently along together, the one weak, the other

strong, the one gentle and the other violent, the one quite unconscious of the other. This condition exaggerated and pronounced is well known as double personality or successive personality. A man suddenly loses the memory of his past, forgets his name, his home, or his friends and is forced to start afresh with a new name and a new occupation. Formerly gentle and cheerful, he becomes riotous and pessimistic. The new character may be the entire opposite of his former self. A girl may play the piano, paint, sing and be cultivated in the one and stupid and ignorant in the other state. Though the character of the patient is entirely changed and his acts appear rational to strangers, they are recognized as entirely foreign to him by his relatives and friends. The patient may leave his family without any cause, commit theft, arson or murder, or on awakening find himself miles away from his home, or accused of crime. In a few weeks or months the condition changes and the former personality is resumed with complete amnesia of the altered self. Sudden onset, changed consciousness and partial or complete amnesia are characteristics of this state. This puzzling and apparently unnatural condition, is easily explained when we remember that self is a continuous flow of conscious states influenced by and linked to the unconscious in which are imbedded the experiences of a lifetime. Consciousness shifts and if it does so more or less definitely and permanently and assumes new relations with the past, then we have these peculiar conditions that rise out of the depths of unconsciousness. It may be graphically given on the former plan.

FIRST AND SECOND SELF, SUCCESSIVELY OR SIMULTANEOUSLY EXISTING.

The process is one of dissociation. Hysteria and epilepsy produce these states not infrequently and the circular forms of insanity, melancholia and mania, are similar conditions. Hypnosis also gives an altered personality, and altered consciousness, depending entirely upon the suggestions of the physician, with whom the hypnotized remains *en rapport*. It is a narrowed consciousness not entirely dissociated from the background. The patient can resist and does so more or less, depending on the state of hypnosis and on his unconscious self, that is, whether the suggestions of the hypnotist find tendencies and predisposition out of the usual pathways. A moral person will not likely accept an immoral suggestion, steal or murder. In fact, it has been

questioned whether such a suggestion ever could be executed. Amnesia if suggested, follows the somnambulistic state.

In successful hypnosis the attention of the hypnotized is entirely controlled by the physician. He is blind and deaf to everything except to the suggestions of the hypnotist, which he carries out. Religious ecstasy is self hypnosis and a conversion may change the entire personality. The hypnotist determines the ideas of the hypnotized, only more so than the preacher, or orator, whose speech is attentively followed. There is nothing unusual in hypnotism and the greater attention is explained by the state of abeyance, a partial sleep in which the mind has been placed. The hypnotist suggests an idea, which is executed in the usual way and with the usual apparatus. In the waking condition there is a struggle between opposing ideas before one—the strongest is executed. In the hypnotic state all the opposing ideas are suppressed with the exception of a few, that are well and firmly established. Suggestions are accepted with varying readiness on this account as well as on account of the state of hypnosis and the confidence the hypnotized has in his physician.

A suggestion given during hypnosis to be executed at a certain time after awaking is usually obeyed. It is known as post hypnotic suggestion and is very valuable for therapeutic purposes. The hypnotized is not aware that the act to be performed at a certain time has been suggested to him and if asked why he did it gives varying explanations that may or may not suit the case.

It has been mentioned that it is impossible to make anybody do anything to which he is strongly opposed and the accepted suggestion is always modified by the habits and interests of the subject. Likewise an orator cannot arouse the same feelings and the same ideas in various persons, all will feel and think differently, influenced by their unconscious knowledge.

Time is well measured in sleep and in hypnosis, and in the waking condition, without our being aware of it, the suggestion is executed at the stated time automatically. The process does not differ from many others similarly performed in the waking state. By this means menstruation can be regulated and sleep produced at a certain hour. The idea compels the subject to perform the acts at the time suggested.

Hypnosis is usually easily produced by suggesting sleep. It is sleep or partial sleep, and anything that will suggest sleep will be of assistance to produce hypnosis. A quiet and darkened room, a soothing, monotonous, but convincing voice, are helpful. Sleep

depends upon fatigue and suggestion and so does hypnosis. If the patient is told to look at a shining object and that he will fall asleep the effect is produced by tiring one sense, coupled with auto-suggestion, and the same effect is produced when the patient is directed to look into the eyes of the operator. Hypnosis should not be produced against the will of the patient. This is certainly possible with susceptible persons and the physician, for his own protection should have a witness in the room. Every physician who employs this measure finds a method with which he will best succeed. Self-confidence is absolutely necessary—the slightest doubt as to his own ability, is readily observed by the patient and will prevent success. Like begets like and thoughts produce identical thoughts. I commence with explaining the measure, according to the intelligence of the patient, avoiding the word hypnotism, finding that my patients have a preconceived idea of something miraculous and supernatural about that, and therefore, use the word suggestion. I tell them that to make an impression strong and lasting, attention is necessary, and that this is best secured when the patient is dozing, with eyes closed, all the outside influences removed and he is not able to hear or pay attention to anything else except what I tell him. During all this time I give suggestions of cure and restfulness, place the patient in a comfortable position, half darken the room, take his hands lightly in mine, direct him to look at me and fix a point between his eyes, continuing the conversation in a low monotonous voice. I tell him that I can see how his nervousness is disappearing, that I can see him getting sleepy and can feel the blood coming to his hands, that his hands feel warm and heavy, that his eyelids commence to droop and get heavy—heavy, as lead, they close right away, that they will be closed by the time I count three. Even before that he has usually closed them. I make a few light passes to enhance the effect, then continue the conversation with impressive suggestions of cure and hopefulness, tell him that he will improve from day to day, that the various methods and drugs for treatment adopted are bound to cure him, that he will now have patience and not interfere with the process; suggest cheerfulness, sleep, bowel action, normal digestion, etc., and whatever may be necessary in each particular case. I do not trouble about whether I have produced somnolence or somnambulism. All I wish is the attention of the patient and to convince myself the suggestions are accepted. After having given the suggestions, I tell him that he will wake up refreshed, and without pain when

I count three. I do this slowly and do not raise the voice, and avoid during the whole process any shock or jar or excitement, but on the contrary do all I can to quiet and soothe.

Confidence comes with success and practice. However, as stated before, hypnosis is rarely necessary and we get along in most cases, at least, with suggestion in the waking condition. I employ hypnosis only with very nervous and hysterical subjects, or with patients where it is next to impossible to secure attention otherwise. Contrary to the opinions of many observers, I find these patients very susceptible.

Psychotherapy is useful in the treatment of every disease. There is no nervous disease without a physical basis, nor is there any organic disease without nervous symptoms and the functioning of organs is disturbed in every disease. With this method we can restore the organs to better and more harmonious work. It is true that this method alone is not sufficient in many cases to cure, but what method is, all have to be combined for one purpose, to produce pure blood and to restore its normal distribution. With psychotherapy we can influence extensively almost every function of the nervous system, circulation and respiration, digestion, menstruation, micturition, defecation and perspiration; redden or blanch the skin *ad libitum*; alter the mental activity; stop fright and excitement; quiet and soothe and change habitual morbid thoughts to healthy ideas of hope and cause improvement and cure that extend into the normal condition of the mind, and influence the patient constantly and profoundly during life. If disease has made a deep impression upon the mind, the slightest stimulation will produce the original painful sensation. The "Railroad spine" of the woman that falls and hits the end of the spine, and feels the pain years after physician and Roentgen rays have failed to show any trace of injury, illustrates this. A strong and opposing idea of improvement and cure will gradually obliterate the trouble and this can be best achieved with this method of treatment. We can directly influence, stimulate and paralyze sections of the vaso-motor system and increase or decrease the amount of blood passing through an organ, increase its functioning or decrease it. We irritate the cortical centers, which send motor impulses along beaten tracks to the lower centers that preside over and regulate organic functions.

Amnesia can be suggested and pain stopped. If a wound is made by thrusting a pin through the skin, lip or cheek, it will not pain or bleed if the suggestion is given that it will not do so, or

that the part is dead, showing absolute control over the vasomotor system. Moods and feelings can be changed and a gloomy and pessimistic disposition made cheerful. Appetite can be increased, insomnia cured and will-power strengthened. How much can be done depends on the quantity and quality of the brain, inherited or acquired. An absolute dissociation is not possible, some linking remains.

Every suggestion is taken according to the intelligence of the hypnotized, just as the speaker influences his audience. If any object is suggested, no matter which, it will be seen as the hypnotized knows it best. For instance—a city, a house, a dog, etc., will be seen differently by different persons, unless it is distinctively otherwise specified. Auto-suggestion is frequently used by the patients and very successfully. They wear medals of silver, copper or brass of some saint around the neck, a string around the belly or wrist, or some amulet. They remove warts and moles by stroking them, murmuring some formula and looking at the waning moon, etc. These charms are numberless. Physicians use suggestions in their daily practice, injecting water instead of morphine, giving the assurance that a medicament will cure, suggest sleep and improvement and unfortunately frequently do harm with a bad prognosis or an unguarded statement or expression of their face.

If suggestion can be transformed into firm and well fixed habits of thoughts and actions, they are bound to become permanent. Forming new habits by this means, we associate dissociated and disassociate associated ideas.

Faulty habits often produced by auto-suggestion can be cured by suggestion, which is also the best method of education. The suggested idea, based upon the past experience appears so vivid in the narrowed consciousness of the subject, that he thinks he experiences it at the time. If using suggestion in any of its forms for therapeutic purposes, we aid its effect by touching the painful parts, or rubbing them lightly when giving the appropriate suggestion, telling the patient that the pain is disappearing or that we have magnetized it, that we have removed the congestion, etc., we associate the sensation of touch and strengthen thereby the suggestion. If we wish to cure atonic constipation, due to lack of nerve force, we send a strong wave of force down the usual tract, causing increased peristalsis, but if due to spastic contractions of the colon, we soothe central irritation, establishing a new and firm habit of evacuation as to time

Defecation is an automatic act, and must not be interfered with when once the habit is established, which is more readily done, by associating it with an accustomed task, getting up in the morning, drinking a glass of water, smoking a pipe, eating an apple or a soft boiled egg, taking a spoonful of honey, etc. Most patients have found this out for themselves.

The action of psychotherapy does not differ from that of any other therapeutic measure. It restores disturbed functions to the normal, increases when organs are working below par, decreases their overaction, and it also improves the composition and distribution of the blood. We live by sensations and they are the means to produce the desired effect. We can influence every cell in the body, every activity of the brain and the functioning of every organ. There is no difference, whether the suggestion is given with, or without hypnotism, or by auto-suggestion—the effect is the same. Anyone is apt to feel nauseated and to throw up on finding a few flies or a few hairs in his soup, or have his bowels distorted on receipt of shocking news, and every patient who expects to get well, eats better, sleeps better and has every organic function well stimulated. The application of suggestive therapy, like any other method, is based on a correct diagnosis, and without it, cannot be used with full advantage and may do harm. Pure blood and its perfect distribution is health, and with this method intelligently used, we can purify it and bring it where needed.

CHAPTER IX

HYPEREMIA

Bier published his first article on this subject twenty-eight years ago. His first publications, revolutionizing the accepted views on hyperemia, were received with doubt and protest, and not until after fifteen years of controversy were his views and methods of treatment generally accepted.

Hyperemia as a method of treatment was introduced by Bier, and as a surgeon, he was, perhaps, best qualified to prove its efficacy, in the treatment of local affections, with which the surgeon has to deal; he was able to exclude all other influences, devise new methods and use old ones, which had been empirically employed, demonstrating and explaining their curative action in disease.

It is well known that the human organism can resist disease and possesses means of defence, not alone to prevent its progress and spread when it has commenced, but to repair damage caused by it. The majority of people recover without the help of doctor or medicine from their ailments and this is sufficient proof that the human body possesses means to cure. Some of Nature's methods are striking and cause an immediate effect. An abnoxious substance that has entered the trachea provokes a violent coughing spell; a foreign body in the eye, a profuse flow of tears, and stomach and intestines remove obnoxious substances with vomiting and diarrhea. "Infectious agents that enter the organism mobilize its defenses and the cause of the damage becomes at once its destruction and removal."

It has been long recognized, that fever is one of Nature's means to cure, and it was for Bier to show that inflammation is one of the most important processes to fight disease.

Disease becomes possible only when the natural defenses of the body are broken down, when the resisting power of the organism is weakened. The physician can assist Nature in her struggle with disease, protect the organism, increase its defenses, curb Nature when she does too much, aid and stimulate when she does not enough.

Every important phase in life is accompanied by hyperemia—growth, regeneration, the process of reproduction, pregnancy, and every organ when at work, is hyperemic; every reaction upon a foreign body, large or microscopic and every focus of disease, is surrounded and impregnated with blood and serum.

Bier recognized in this universal re-action to injury, Nature's universal remedy.

Pure blood in sufficient quantity cures, and blood in insufficient quantity and impure blood, delays and prevents recovery.

Nature causes hyperemia through nervous influences, by slowing the blood current, or increasing its velocity, and to assist her in her work we have to aid this process, which creates an active or passive hyperemia, or a condition, which it is sometimes difficult to say whether it belongs to the one or to the other class. There are a number of various states of hyperemia that pass gradually from one into the other and frequently no definite line of demarcation can be drawn. It may be said, however, that an active hyperemia is arterial in character, when a large quantity of *blood* flows into a certain part of the body, passing through rapidly, to be constantly followed by new waves of arterial blood as long as this condition lasts. A passive hyperemia is characterized by a large quantity of venous blood, that is contained in a certain portion of the body and passes slowly through it, bathing the tissues and overflowing them.

Nature employs active hyperemia to furnish nutrition to working organs. The velocity of the blood current is increased and the muscles filled with blood during exercise, stomach and intestines during the hours of digestion, and the brain during mental work. This is shown by flushing of the face and by heat waves when the work is taxing—and the skin shows the increased blood supply by redness and perspiration. The usual stimulus for this condition is heat, and its purpose is to keep the temperature of the organism within safe limits. The blood that reaches the surface in continuous waves, returns cooled to the centers and reduces body temperature. Glandular secretions become free under the influence of an increased active hyperemia; and so on. Every organ during work is hyperemic and the hyperemia is active.

Passive hyperemia is employed by Nature during repair, regeneration and growth. Sleep slows the blood current, organs are at rest and repair of daily wear and tear takes place. Injury, whether large or small, is immediately followed by a passive

hyperemia, and during embryonal life, growth is immense, work little, and blood supply only partly arterial.

It is *especially* the passive hyperemia that accompanied every injury—the main feature of inflammation—that was up to recent times considered dangerous, and was fought with might and main by every practitioner. Bier proved that it is beneficial, and that it is Nature's means to repair and cure. He had to make his hardest fight to overthrow the firmly rooted idea. Whether an active or a passive hyperemia is needed, or a mixture of both, it is produced by nervous influences. Central and peripheral nerves answering to accustomed stimuli by increasing the velocity of the blood current or by slowing it, supply the demand. It may be a morsel of food in the mouth that calls for the activity of the digestive apparatus, a microbe that has entered the organism, or a blow received, the result is the flow of blood to the part where it is needed, in the form of an active or passive hyperemia, in whichever way it may be most useful.

I call attention to this feature from the point of the internist and general practitioner, who has to deal with the treatment of internal diseases, has to produce the desired effect through the nervous system by known therapeutic methods, and can but rarely use the ingenious methods devised by Bier, valuable in the treatment of local injuries, to produce hyperemia.

The effect of hyperemia upon the lymph current has been thoroughly studied, and the opinion is unanimous, that inflammation and passive hyperemia increase lymph secretion and influence the lymphatic current.

To produce a passive hyperemia for experimental purposes, most observers usually compress or ligate a large venous trunk. Bier applied bandages around an extremity, or cupping, caused in this way, not alone a compression of the the veins, but also of the lymph vessels—producing a blood and lymphstasis more complete.

The results obtained with active hyperemia are quite different. Some have observed an increase of velocity of the lymph current and of its volume, and others maintain that the former is but little or not at all influenced by an active hyperemia.

If we consider the means by which the hyperemia in these cases has been produced—introduction of poisons like nicotine and curare, to cutting of a nerveplexus, or of the spinal column, or similar measures, such difference of opinion can cause no surprise. Each of these experiments has to stand by itself and does

not prove anything except the particular cause and effect. Though we do not know as yet precisely how an active hyperemia influences the lymphcurrent, it may be safely taken for granted that the measures usually employed for therapeutic purposes, especially heat, increasing velocity and volume of the blood current, produce a similar effect upon the lymphcurrent. It is difficult to see why the same force—heat for instance—should affect the blood current and leave the lymph current unaffected. An inflammatory process changes the character of the lymph, which in this condition is a thick liquid of yellowish color, easily coagulating and containing a large number of white cells and but few red cells. The lymph due to stasis is a very thin liquid, light reddish in color, contains a larger number of red cells and but few white cells.

Every hyperemia, active or passive, stops pain, and means to produce it for this purpose have been used since time immemorial; though the explanation for this remarkable feature was, up to recent times, not the hyperemia, but an anemia supposed to be produced by the various means employed—"Heat, cupping, poultices, etc.," in the injured portion of the body below. It was thought that removing the hyperemia and especially the passive hyperemia, accompanying inflammation, was the most important means to relieve and to cure, and methods to accomplish this were in daily use. For instance, the high position in which every injured joint was placed to prevent hyperemia and to remove it when present, may even now be seen occasionally in hospitals and in private practice. Before Bier's great discovery, that hyperemia stops pain, it was the measure adopted without exception, apparently borne out by the common experience, that pain increases, when an injured arm or leg is allowed to drop, decreases when the same is placed in a high position, and disregarding the fact that pain is soon felt more severe if the extremity is placed high, and gradually diminishes, if kept in a horizontal or low position. The pain in a wound is due to the bruised, crushed nerve endings and cells, and not to the hyperemia.

Hyperemia, no matter in what form, active or passive, stops pain, and it does so in every disease. Headache, neuralgias and myalgias, joint pains due to different causes, etc., all are relieved in a short time. Bathing the tissues with serum lessens the sensibility of the injured nerves, prevents friction in joints, and at the same time frees them from toxic substances and removes and destroys the cause. For neuralgias, active hyperemia is best

employed, but for all other cases, passive hyperemia is the most effective.

Passive hyperemia prevents stiffening of joints and their fixation in faulty positions.

Aside from the rapid recovery of a local infection and the favorable change in the general condition of the patient, with the employment of this remedy, Bier has furnished conclusive proof that hyperemia acts bactericidally. He has made large abscesses filled with quantities of staphylococci sterile, by treating them with passive hyperemia. Others have confirmed his observation by experiments on animals.

Noetzel could keep fifty-one out of sixty-seven rabbits alive, after injecting them with a fatal dose of anthrax bacilli into parts of the body made artificially hyperemic. Sixteen out of the number died and their death was found due to a faulty technic, which had produced in these cases a cold edema instead of the hot edema, which latter is curative. All died after a second injection made with the same bacteria without the passive hyperemia, proving that this alone had prevented their death after the first injection. Other observers have proceeded in different ways, with similar results, proving that passive hyperemia kills bacteria, so that this may now be considered a well established fact.

An accumulation of antibodies in the injured part and of products of bacterial metabolism, an increase of carbondioxide together with an increased alkalinity of the blood, and a large influx of leucocytes to the diseased focus treated by hyperemia have been advanced to explain its bactericidal action. For all practical purposes it is sufficient to know that hyperemia cures.

Inflammation is Nature's means to cure, and it is rational to increase a hyperemia when insufficient and to produce it by artificial means, when the organism is unable to do so. On the other hand, Nature may, just as a faulty technic, produce a cold edema. In such cases means to reduce it have to be employed, changing the posture to facilitate the return flow of the blood, removing the bandage or loosening it, if it has been applied too tight, and other measures as indicated. The slow moving current of large quantities of fresh blood, bathing the injured parts, is the curative factor. Hyperemia acts bactericidally, neutralizes toxins, brings an abundance of nutrient material to the diseased part and removes injurious substances. A disease in which Nature rarely does enough on account of the mildness of the toxic agent, or perhaps on account of the partial immunity

acquired, is chronic rheumatism. This ailment is invariably benefited, if not cured by all forms of hyperemia. Tuberculosis is another disease that belongs to this class in which Nature is often unable, on account of lack of vitality of the patient, to produce a hyperemia sufficient to cure. The results obtained in tuberculous joint affections are sufficient proof that this view is correct.

Bier found especially in the study of this disease, that the cold edema is injurious, and that a mastering of the technic is of the greatest importance to prevent harm through this method. The treatment used in contradistinction to that up to recently—the antiphlogistic method—relieves pain, decreases or stops fever and increases mobility of the affected joint by destroying the cause, whereas, the former icebag, rest and high position obtains results far inferior, mainly by slowing absorption of the poison. The application of the ice bag produces a passive hyperemia, and not an anemia as it was taught, and the cold penetrates the tissues to a considerable depth.

An injury causes a rapid filling of the diseased part with blood, an active hyperemia, produced by an increased velocity of current and a passive hyperemia. The slowing of the blood current in an inflammation is constant and an inflamed part of the body retains blood with great tenacity; explaining that hot applications in the form of compresses and cataplasms, which in health produce an active hyperemia, produce a passive hyperemia in inflamed parts. The hot edema is beneficial, the cold edema injurious and the transudations of kidney and heart disease must not be confounded with an inflammatory edema.

Blood dissolves solid substances and during a process of inflammation, especially of a suppurating process, hard inflammatory interstitial tissue growth, cartilage and bones may be completely dissolved. This process, on account of its resemblance to digestion, was called autodigestion and autolysis, thought due to the action of the leucocytes. There can be no doubt that pus cells play an important role in this process, due to enzymes given off by them, as proven by numerous experiments. That this is not the only cause of the dissolving power of the blood, but that the process is complicated, is demonstrated by the fact that hyperemia alone, active or passive, is sufficient to dissolve solid, morbid substances in the body. Hard nodules and blood coagula disappear under the influence of either form of hyperemia, and stiffened joints become mobile under the same treatment, only possible by a solution of morbid substances and by softening of hard tissues.

The results obtained with the old treatment by application of derivatives is due to their power to draw blood into the affected part, and the curative effect of the treatment of strictures with bougies is due to the same cause.

Landois was the first to prove that the blood possesses the tendency to keep itself free from foreign substances, and that the serum of one species of animals, will dissolve the blood cells of all other species brought into its circulation.

Blood absorbs water and solid particles brought in watery solution by way of the blood capillaries from the tissues of the body, and from body cavities, and fat and minute solid particles are taken up by way of lymph-vessels, though it has been shown that in this process of absorption small quantities of watery solution are absorbed by the lymph vessels, and that blood capillaries may act like the lymphatics under certain conditions; for instance—after the removal of all lymph vessels and glands in an operation. An edema after an operation is rare, which is proof that the lymph is taken up by blood capillaries. If blood absorbs watery solutions, it seems but rational to think that an active hyperemia, that is, a larger quantity of blood, flowing with increased velocity through a certain portion of the body, increases this property—and it does. Edemas produced by disease or by a passive hyperemia are rapidly removed by an active hyperemia, and elephantiasis is favorably influenced by this method of treatment. A too prolonged treatment produces edema due to injury of vessels and nerves, converting an active hyperemia into a passive one. Anemia slows absorption. In anemia we have an insufficient quantity of the solving agent, the blood, and a passive hyperemia slows absorption, as this condition depends entirely on the slowing of the blood current. The lymph current seems to be influenced by the measures that produce hyperemia in the same way as the blood current, though proof of this is not complete.

Passive hyperemia—shown by swelling—to prevent the flooding of the system with poison that has entered the body, is rapidly produced by Nature after the bite of a venomous reptile. This has long been made use of by applying tight bandages around the extremities and by cupping. It was thought that the poison was removed and the wound cleansed by the suction of the cup, but it is now conceded that the passive hyperemia produced, is the active agent, delaying the passing of the poison into the general circulation and neutralizing and destroying it before damage can be done to the system.

The action of living tissues to destroy and neutralize poisons, increases the curative effect of the passive hyperemia. In order to prove that the tissues possess this property Donath injected into the hind leg of a rabbit, which had been previously made anemic with an Esmarch bandage, a dose of strychnine, sufficient to kill under ordinary conditions in from two to five minutes. The animal remained in perfect health from one to four hours before the bandage was removed, showing that the poison was made innocuous during that period. Others have confirmed these observations. It is thus proven beyond a doubt that active hyperemia causes an increased absorption, and that passive hyperemia destroys and neutralizes poison and permits it to enter the general circulation only in small quantities, which may be removed before they can damage the system.

Joseph injected into portions of the body of rabbits that were made edematous a lethal dose of strychnine and could keep six alive. To prove that the effect was due to dilution and delayed absorption, and not to a specific action of the blood serum, he repeated the experiments with animals in which the edema was produced with normal salt solution and obtained the same results. Joseph's experiments prove that simple dilution and delayed absorption contribute largely to the results.

The influence of hyperemia on nutrition seems to need no further proof. Oxygen is absorbed in the lungs and carried to the cells of the body, and the food after it has passed through the process of digestion is finally taken up by the blood, from which the cells select what they need to live. Hyperemia, active or passive, means an abundance of food supply, necessarily favorable to growth. However, more than food is needed to cause it—a stimulation, not as yet fully understood. Numerous observers have reported cases of venous thrombosis followed by an increase in volume of the diseased extremity, apparently due to muscular hypertrophy. All, however, report weakness and twitching in the affected muscles leaving hardly any doubt that the increase is due to disease, a stage of degeneration, and not to true muscular hypertrophy. Ellenburg found fat infiltration and degenerated muscular fibers, and Oppenheim and Simerling called attention to the fact that muscular fibers taken from the living appear hypertrophied under the microscope, disproving the observation of those that claim to have proved the occurrence of muscular hypertrophy in the affected extremity by microscopic examination.

These observations lead necessarily to the conclusion that the enormous and lasting passive hyperemia caused by venous thrombosis, is not sufficient to produce a true muscular hypertrophy. Bier mentions that in many hundreds of cases treated with passive hyperemia for therapeutic purposes, he has not observed a single case of muscular hypertrophy and justly ascribes local improvement due to general improvement obtained by curing the fundamental disease. These observations have been confirmed by many others.

Not a single case of organic hypertrophy has been traced to hyperemia. On the contrary a chronic hyperemia of the liver will lead to atrophy and cirrhosis. The spleen under the continued influence of hyperemia in cardiac disease, develops interstitial tissue growth and the liver shows atrophy degeneration of liver cells with increase of fibrous tissue. Degenerative changes of the parenchyma takes place when lungs and kidneys remain hyperemic. Chronic inflammation causes interstitial tissue growth, and retention of blood and lymph. A passive hyperemia—may cause elephantiasis. It is also a well established fact that during a chronic inflammation, bones grow in thickness and length. The growth is permanent during life—absorption of bony growth will not take place after the inflammation is cured. The surgeon uses an artificial inflammation to cause union of old fractures, and to stimulate bone growth by rubbing the ends of the factured bones together, by inserting foreign bodies, driving nails into the bones, or stimulating the periosteum alone in conjunction with passive hyperemia. That the growth is due to the passive hyperemia that accompanies the inflammation, seems to be proven by cases in which a pure venous hyperemia caused by aneurysms has produced the same effect, lengthening and thickening of bones. The drum-stick-fingers observed in cases of bronchiectasis, advanced phthisis, chronic heart disease and emphysema, conditions that produce venous hyperemia, are no doubt due to the same cause. Hair and nails grow faster during the summer, when the skin is hyperemic and the surgeon's arms are covered with hair, due to the constant washing causing an hyperemic condition of the skin.

These observations prove that under the influence of a chronic passive hyperemia—bones grow, interstitial tissue growth may be produced and the growth of hair and nails is more rapid. Roux states that only organs with passive functions, supporting tissues and covering epithelium, but never organs with active function, muscles, nerves and secreting epithelium, grow under

the influence of passive hyperemia, to the exclusion of every other stimulation.

Virchow's statement—that the cell cannot be nourished, but nourishes itself and rejects the surplus of nourishing material, if not at the same time irritated by unknown stimulants, such as injury or hormones, to cause increased growth and reproductions, is a law that governs cell growth.

Injury produces inflammation—a demand for repair, and causes hyperemia. Injury to the epithelial cells of the skin by the rays of the sun in spring and summer is followed by pigmentation to protect the body, and the injury caused by washing and rubbing with antiseptics increases growth of hair and nails upon the surgeons' arms and hands.

Exercise and work stimulate muscular growth and the growth of functioning tissues. Slight injuries produced by work, affect the peripheral nerve endings, impulses travel to the centers, from which motor impulses are sent out. Dilatation of vessels, increased blood supply and repair follow. Injury is the universal stimulus upon the nerve endings—a call for repair. A pure reflex act, sensory impulses to center, motor impulses to periphery is the result. Dilatation of blood vessels follows.

It is plain that without sufficient blood supply hypertrophy is impossible—that “stimulation and blood supply”—are necessary for growth and for regeneration, that highly organized parenchymatous tissue destroyed, cannot be remade, but is replaced by fibrous tissue.

An abundance of nutrient material, a passive or an active hyperemia, will favor the process of healing. Bone fractures show rapid formation of callus and union when treated with passive hyperemia, and this treatment not alone destroys pathogenic micro-organisms, but also encapsulates those that have withstood the bactericidal action of the blood. Cold edema is injurious; hot edema beneficial. A cold edema means a stasis—an insufficient supply of nutrient material.

A large number of observers have studied the influence of active hyperemia upon regeneration, and though the results are not uniform, the majority have come to the conclusion that active hyperemia favors the process. The hyperemia in most of these experiments was obtained by cutting the nerves by so violent a method that the results have to be taken with this consideration. Pensold in his experiments made in 1895, used hot air to produce an active hyperemia, and his observations seem to be conclusive.

One ear or leg of a rabbit was brought into an apparatus heated to a temperature of 38 degrees C., whereas, the other organ was cooled at a temperature of 10 degrees C. in the same apparatus, which the experimenter had constructed for this purpose. The animal was removed only a few hours during each day. He observed that open as well as subcutaneous wounds healed more rapidly in the hyperemic than in the anemic ear, and that fractures of the ulna formed perfect callus, and united in the leg treated with hyperemia in seven days, whereas, in the anemic leg, the process of regeneration had barely commenced. These experiments demonstrate that abundance of nutrient material in the form of an active hyperemia favor the process of regeneration. We can daily observe this in practice. Injuries will not heal unless blood is brought in sufficient quantity to them. Hot applications in forms of poultices and cataplasms are means commonly used to make bruised and injured structures hyperemic.

Repair and generation of cells is favored by slowing of the blood current and the work is best done during rest—sleep. Hyperemia accompanies every inflammation, and causes the development of the fertilized ovum to the embryo and foetus in the womb. An increased velocity of the blood-current in an active hyperemia, carries a larger amount of oxygen to the cells and favors processes of oxydation and disoxydation and the removal of waste. Active hyperemia is needed for work; passive hyperemia is needed for repair, and growth. Though the slowing of the blood current brings the tissue cells in close contact with the ingredients of the blood far better than the rapidly flowing arterial current, it does not mean that cells answering a stimulation for growth or reproduction, may not select their proper nutriment from a rapidly flowing blood current, and in fact, the experiments made with active hyperemia prove this beyond a doubt. Complicated compounds are used to build up tissue and little energy is needed for this purpose. The oxygen present in the venous blood is probably sufficient. It must not be forgotten, however, that injury minute or extensive, slows the blood current.

MEASURES TO PRODUCE AN ACTIVE HYPEREMIA.

After the removal of an Esmarch bandage, the blood rushes into the anemic extremity and causes an active hyperemia. The application of such a bandage is painful and the hyperemia lasts only for a short while. The Esmarch bandage is, therefore, use-

less for therapeutic purposes. The derivantia produce a local hyperemia and have been used in the practice of medicine since time immemorial. The most useful means and the most widely employed to cause an active hyperemia, is heat. Like the derivantia, used for centuries, the beneficial effect of heat upon diseased structures was not understood. The body protects itself against excessive heat by perspiration, evaporation and largely increased velocity of the blood current to cool the portion affected. It is this last effect that is especially desired, though the elimination of toxic substances through perspiration and other means, discussed in a former chapter, have to be considered. Heat may be applied in form of poultices, cataplasms and thermophores, as sand bath, moorbath, hot water bath and electric light bath.

Hot air is well suited for therapeutic purposes. It is a poor conductor of heat, possesses little heat capacity, and rapid evaporation of moisture protects the body from burns. These properties permit the application of hot air at higher temperatures, than any other method and produce a higher degree of hyperemia. To prove this, Bier inserted an arm in hot water of 44 degrees C. and the other in hot air 105 degrees C. for the same length of time. After removal the arm exposed to the hot water was slightly cyanotic and the one subjected to the hot air was of brighter redness, due to greater velocity of the blood current. Pressure and slight injuries, and inflammatory irritation, caused by the hot water account for the difference. Hot air is now generally used to produce an active hyperemia, and his apparatus in numberless modifications has become a remedy used by the physician in sanitarium and hospitals, as well as in families, to relieve muscular and joint pains. It is a convenient and useful method to produce an active hyperemia. The explanation formerly given was called the decongestive action of hyperemia—the drawing of blood to the surface from internal organs overfilled with blood. Frank showed by his experiments that an irritation of the skin causes contraction of the splanchnics and widening of these vessels of the skin and considers it due to reflex action. The explanation is rational. A larger quantity of blood in the surface means less blood in internal organs. It is wrong, however, to conclude from these experiments that heat applied to the surface is curative, by drawing blood from diseased structures. If an arm, or a leg, is treated with hot air, it increases in volume, and a passive hyperemia acts like the active hyperemia, curatively. A number of observers have conclusively proven that hyperemia may be caused

by the action of heat and other irritants upon the innervation of the vessels alone, entirely independent of the central nervous system. This does not disprove the fact that the hyperemia is not usually brought about by the central nervous system, as Frank's experiments seem to indicate. It is certain that with suggestion and hypnotism, hyperemia and even blisters, may be caused in any portion of the body. The influence of the central nervous system cannot be excluded, though, the body possesses means to protect itself when centers are diseased.

Bier reports an interesting experiment to prove that the increased velocity of the blood current protects—that it acts as a cool stream. He exposed his arm in a hot air apparatus to a temperature of 114 degrees C. without disagreeable sensations. At 115 degrees he felt a burning sensation under the finger nail, but could bear a temperature between 114 degrees and 115 degrees for some time without trouble. The arm moderately perspired. Repeating this experiment, under exactly the same condition with the arm in a state of passive hyperemia caused by a bandage applied above the elbow, he could not raise the temperature above 98 degrees C. without causing severe pain. Increasing the hyperemia by tightening the bandage, he could not raise the temperature above 78 degrees C. An increase of velocity of the blood current protects from burning and slowing of the blood current favors it.

Passive hyperemia does not prevent perspiration. An arm in a state of passive hyperemia treated with hot air perspires. Animals that do not perspire, like dogs, protect themselves against the action of excessive heat, by increasing the velocity of the blood current by rapid respiration.

The larger amount of blood and the increased velocity of the current acting upon diseased tissues, are the curative factors of an active hyperemia, though perspiration, eliminating toxic substances, is an additional and not unimportant adjuvant, even in the treatment of local affections. In the treatment of constitutional disease with hyperemia, the change in the distribution of the blood, which, instead of gravitating towards the center, is drawn into the skin, the loss of water carrying toxins, rapidly replaced by pure water, are points to be considered. Good results are obtained by treating stiffened finger-joints with hot air, though the amount of perspiration in these cases is slight. This merely proves that active hyperemia without perspiration may cure. This does not disprove the beneficial effect of perspiration. Perspiration

commences at 45 degrees to 50 degrees C., increases with increase of temperature up to 60 degrees to 70 degrees C., and then commences to decrease so that at a temperature of 80 degrees to 90 degrees C. the skin feels dry. This is due to an increase of evaporation and tiring of the sweat glands. Hyperemia increases with increase of temperature.

Local treatment with hot air, for instance of one joint, often improves other joints. This is explained by the fact, that to make one extremity hyperemic, blood is drawn from the internal organs. The change of the general blood distribution benefits other diseased portions and by decidedly improving the diseased focus, the whole organism is improved. A patient affected with pulmonary tuberculosis, will often improve after excision of a tuberculous joint. The blood is purified, less poison is absorbed, and the consequent better nutrition leads to general improvement.

Figure 1—No. 1, Hot-air Chamber for the Foot.

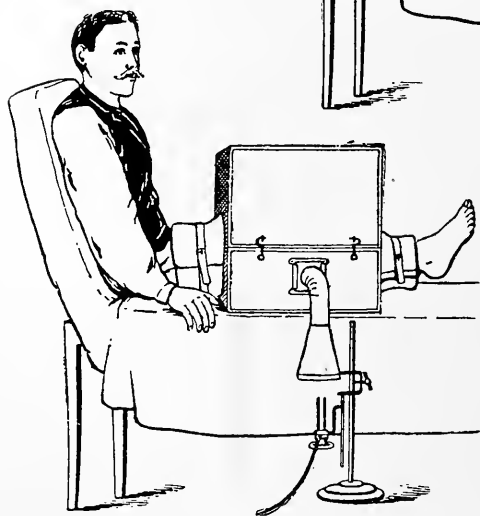
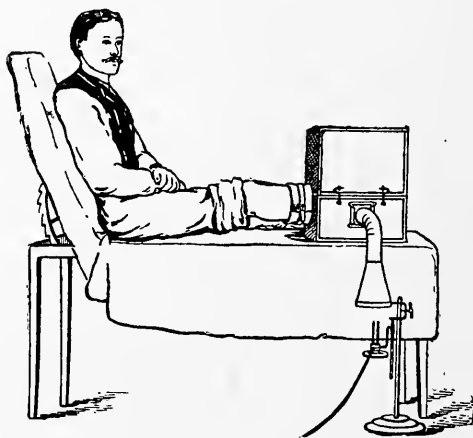


Figure 1—No. 2, Hot-air Chamber for the Knee.

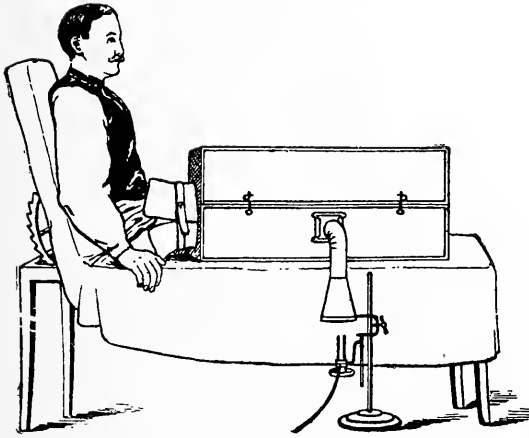


Figure 1—No. 3, Hot-air Chamber for the Whole Leg.

Figure 1—No. 4, Hot-air Chamber for the Hand.

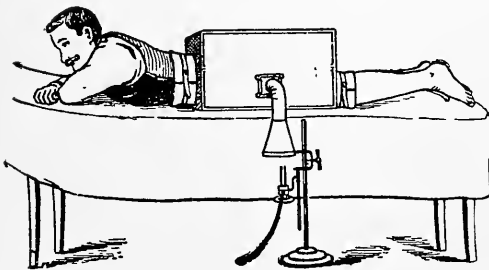
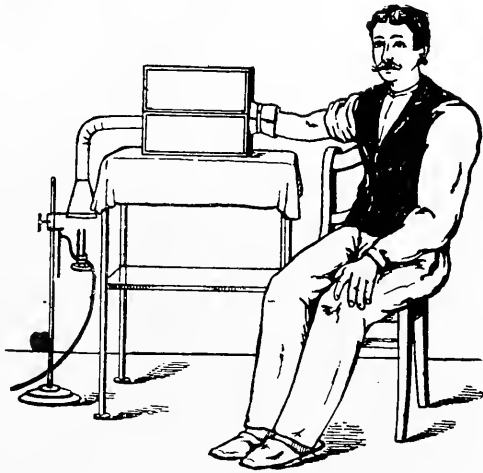


Figure 1—No. 5, Hot-air Chamber for Both Hips.

Bier's original apparatus for the treatment with hot air is characterized by its simplicity, cheapness and easy application. (Fig. 1—Nos. 1 and 5). It consists of a wooden box, lined with heavy linen, both box and linen are thoroughly saturated with liquid glass to prevent it from burning. The box contains, according to the seat of the trouble, one or two openings through which the extremity is inserted. For instance, for treatment of foot or hand the former; for treatment of elbow and knee, the latter contrivance is selected. The top of the box contains a few draft holes and a thermometer. After the extremity has been comfortably placed upon felt, the box constructed to open, is closed and the openings are tightly packed with asbestos wool, or enclosed with a cuff. The heating is done with a Bunsen burner or alcohol lamp placed under a chimney that enters the box. The temperature is regulated by raising or lowering the Bunsen burner or alcohol lamp.

The apparatus may be fitted to any portion of the body and is so simple that any carpenter can make it according to measurements. Some practitioners envelope the treated extremity in cloth, to securely protect it from burns and to insure an even exposure to heat; others prefer to treat without this measure, as the moist heat produced by the saturation of the cloth with perspiration, interferes with the arterial hyperemia produced by dry heat. An iron tube is placed near the bottom of each box, over which the chimney is fitted, and in front of the opening of the tube, a small wooden plate, saturated with liquid glass, around which the hot air has to pass to prevent burning. If a composition of various hygroscopic salts is placed in the box, it will take up every trace of moisture and if the diseased extremity is placed in an asbestos cylinder, so that the hot air does not touch the skin, it will prevent any danger from burns.

Various modifications have been made to secure an even exposure of heat. Tender parts, toes—for instance—may be protected by wrapping them up in cottonwool, saturated with liquid glass.

It is of importance that the apparatus is large enough to furnish a good air capacity. If too small, the hyperemia produced is insufficient for successful treatment.

Apparatus constructed after Kelly's electric light bath, have been introduced to take the place of the hot air apparatus. They are not as serviceable as these, on account of the absence of a draft. (Figure 2)

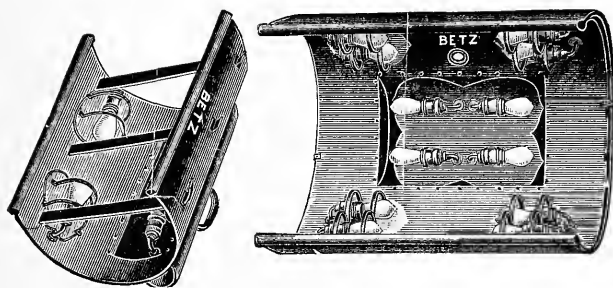


Figure 2—Body and Limb Bath:

The hot air douche changed with the cold douche does well in the treatment of neuralgias. The hot air current can be directed to any particular place of the body.

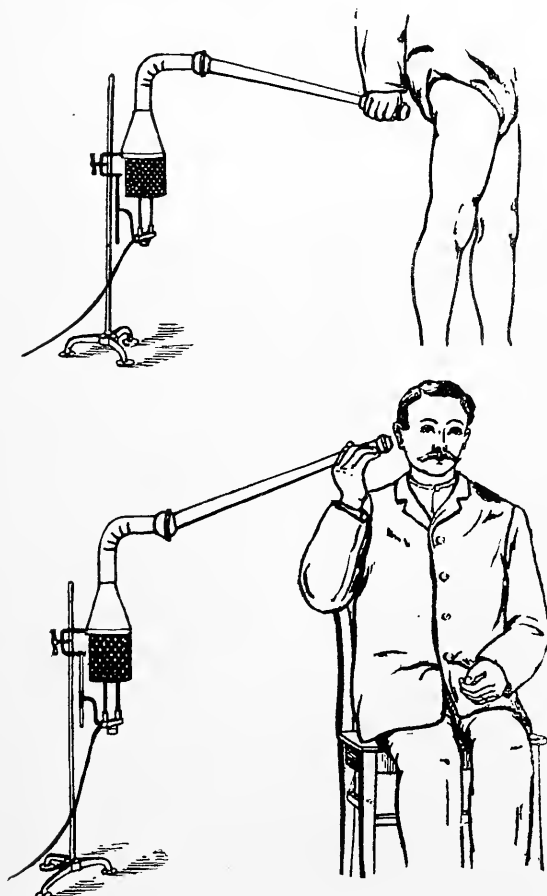


Figure 3—Hot-air Douches.

A very useful apparatus to treat neuralgias consists of a metal funnel connected with a bent tube, drawn out to a point, placed upon a stative, as used in chemical laboratories for filtering purposes. Below the funnel, the Bunsen burner, or alcohol lamp is placed to heat the air. (Figure 3)

If an extremity is treated in a hot air apparatus, it will be observed that at 50 degrees C. it becomes slightly moist, perspires freely between 60 degrees C. and 70 degrees C. and after an exposure of 100 degrees C. for some time, the perspiration increases, so that the water drops from the exposed member. The perspiration decreases if the temperature is still further increased to the bearable 114 degrees C. Hyperemia increases with increase of temperature and length of time of exposure, provided that the exposure does not last over an hour. If after this process the extremity, now of bright red color, is carefully dried and wrapped, agreeable sensation of warmth remains, and the surface thermometer shows an after effect, and an increased temperature, lasting for over an hour. The treatment of one portion of the body with hot air causes perspiration of the whole body, different in each patient so treated. Fat and weak persons perspire usually very freely, whereas, the strong and lean, are but little affected. Burns should be avoided, though, if light superficial burns should occur, they heal usually very quickly. The brown discolorations of the skin often met with, after long treatment and due to slight burns that cause decomposition of red cells and deposit of pigment matter in the skin, disappear gradually and are of no consequence. A cold compress to the head during the treatment of weak patients will prevent fainting spells, palpitation, headache and weakness, though occasionally, we meet with people that cannot stand the hot air treatment. The room should be well ventilated. Not rarely, these complaints are due to a badly ventilated room. To avoid colds, the patients have to be thoroughly rubbed after treatment and rest from one to two hours in bed. The treatment should last from one-half to one hour a day. The effect upon the general circulation is considerable, and if menstruation becomes profuse and too frequent, it is best to interrupt the treatment. The appetite is variously influenced. Some complain of loss, others are not influenced at all, and some find their appetite increased.

PASSIVE HYPEREMIA

Just as active hyperemia, passive hyperemia has been used for many centuries and cupping and suction apparatus made up a

part of the armamentarium of the old physician. The hyperemia produced with a bandage has been used in the treatment of fractures, and bandages around the extremities to stop hemorrhages have been a time honored remedy. Bier has explained the curative effect of a passive hyperemia and has completely overthrown the old theory, that it is injurious, and must be removed with an antiphlogistic treatment. To treat the diseases of the extremities with passive hyperemia, a bandage is placed above the diseased part, over a larger portion of the arm or leg, so that the flaps of the bandage do not cover each other completely. If the disease is located near the shoulder, less space is at disposal and the flaps of the bandage have to cover one another. It is tightened just enough to compress the veins and not to affect the arteries. Any degree of hyperemia may be produced by more or less tightening the bandage, from the slightest to the most severe form. Light pressure does not cause an inconvenience. Application around the arm causes the veins of the back of the hand to swell, and next the veins of the elbow joint. The skin of the arm assumes a bluish color, hand, fingers and extensor surface of the elbow turn light red, with small white circumscribed spots in the palm of the hand, and upon its back, and the small veins, usually not visible appear injected. In three hours the arm has turned blue-red, the skin around the elbows has become crimson and the mottled appearance of the hand has disappeared. Pressure made with the finger shows beginning edema. The pulse is full and strong. After ten hours, the edema has become marked, and after twenty hours, arm and hand are edematous. The skin of the palm of the hand and the fingers, and the back of elbow and wrist-joint are still light red, the rest of the arm appears blue-red, though vigorous friction causes arterial redness everywhere. The subcutaneous veins have become almost invisible. The blood current is slowed, but not obstructed, demonstrated by stretching the arm, which causes paling. The temperature of the hyperemic arm is slightly reduced.

If a diseased part of an extremity is treated with the degree of hyperemia usually employed for therapeutic purposes, the reactions are more severe and the difference in temperature amounts to from 1 degree to 3 degrees C. If the bandage is tightened so as to produce a severe form of hyperemia, the effect is as follows:

The pulsation of the arteries is felt below the bandage, the subcutaneous veins swell rapidly and the skin turns blue and gray-

red, with a few light red spots in the palm of the hand, deep scarlet-red and yellow spots scattered over its back, and over the extensor surface of the elbow joint and radial side of the arm. The scarlet-red spots increase rapidly in size and pass into one another, so that in a few minutes, the whole arm is of this color. Carmine red points appear upon the flexor surface, due to minute hemorrhages into the skin and the arm feels heavy and tired. At the same time cribbling and a sensation of heat and cold is felt in the extremity.

Vigorous friction causes a lighter redness, though a tinge of yellowish and copper color remains. The minute hemorrhages increase in number and white yellowish spots appear in the palm of the hand and on the tips of the fingers. The extremity is cold, though the subjective sensation is that of warmth. The color of the palm of the hand turns gradually ash-gray, mottled with scarlet-red and white spots. The red color turns white under pressure, with visible numerous minute hemorrhages, to turn red as soon as the pressure ceases. The bandage has to be loosened in forty minutes, on account of unbearable pain, the arm feels cold and as if treated with the faradic current, and turns rose-red. The feeling of warmth returns, but a sensation of muscular stiffness and tiredness remains for nearly an hour. The skin shows numerous capillary hemorrhages, which disappear in twenty-four hours. The skin of the arm turns a yellowish-brown color. The discoloration corresponds to the spots where the bandage was fastened. The color disappears in two days and in four days the arm is normal. During the experiment the temperature sinks from 32 degrees to 30 degrees C.

Passive hyperemia affects the deep as well as the superficial part of the extremity treated, and may extend to the bones. This can be frequently observed in deep wounds above which a bandage has been placed.

The scarlet-red color is the expression of an intense hyperemia and may be partly due to blood coloring matter that has passed into the skin and causes also the yellowish-brown discoloration. The white spots are explained by the action of the small arteries and capillaries, pressing the venous blood that accumulates in them into the direction of the veins, and the returning redness after loosening of the bandage, is a beneficial reaction, due to the oxygen grasped by the tissues that have been deprived of a sufficient quantity during the continuation of the treatment, and is not caused by vasomotor paralysis, which was long consid-

ered its origin. The severe hyperemia that produces these serious symptoms, is always dangerous and has been called "cold hyperemia". Forms that are used for therapeutic purposes lie between this and the lightest form described. The degree needed in each case has to be carefully selected and regulated by more or less tightening of the bandage, which to avoid injury, has to be lined with flannel and changed from place to place.

It is of the greatest importance that the treated member remains warm, free from scarlet-red spots, pain and abnormal sensations, and does not cause inconvenience, not even interfering with the usual everyday occupation. Hot edema is beneficial; cold, injurious. A continued treatment, from twenty to twenty-two hours a day, in acute, as well as in chronic diseases, acts best, with exception of the treatment of tuberculous joints. In these cases the hyperemia has to be constantly and most carefully watched, to avoid a cold edema that will cause serious injury. Bier recommends the application of an energetic treatment, not to cause red spots or pain, from one to two hours per day in these cases. Edema has to be eliminated by elevating the extremity before the new application is made. Any joint may be treated without trouble, except the hip joint, around which it is difficult to place a bandage so as to produce the desired effect.

To treat the shoulder joint, a ring made of a big rubber tube, and lined with cotton, snugly fitting around the joint is so placed as to rest in the axilla. A belt, which passes from the front of the ring around the chest to the back, may be tightened to produce the degree of hyperemia desired. Instead, a big rubber tube may be placed around the shoulder joint in the axilla, passing through the loops of a cloth tied loosely around the neck—the ends fastened with a clamp. A bandage is then tied to the ring and passed around the chest under the axilla of the healthy arm, which may be tightened to produce the desired effect. In order to avoid injury, the treatment should not be continued for more than from ten to twelve hours during the twenty-four hours of the day, and even during this time, it should be frequently interrupted, as a change of the bandage from place to place is impossible. Painting the affected joint with tincture of Iodine to cause a slight inflammation of the skin, and then applying the bandage will produce a hyperemia in cases in which it is difficult to do without it. To treat affections of the head with this method, the hyperemia is produced by placing a cotton rubber bandage about three C. M. in width for the adult, around the neck below the larynx,

and fastening it in the back with a safety pin. The bandage is placed above a gauze bandage, to prevent injury and is tightened just enough to cause swelling and blueness of the face, without causing inconvenience. It may be worn from twenty to twenty-two hours at a time. I have used it on myself in an inflammation of the middle ear for weeks, with perfect result. Arteriosclerosis is a contra-indication to its use. The testicles are treated by pulling one or both organs down and placing a well-lined rubber tube around the root of the scrotum. The ends of the tube are fastened by a clamp. The treatment should not be continued for over twelve hours at a time, as the bandage cannot be changed. It has proved effective in a number of diseased conditions of these organs; also in tuberculosis and old fistulas following a gonorrheal epididymitis.

Hyperemia stops pain and the technic is wrong, when it causes pain or inconvenience. Hot edema is beneficial and the cold stage of hyperemia and edema is dangerous. If the bandage is carefully applied and constantly changed from place to place, it will not cause trouble.

Care and caution are necessary to use this method successfully. A passive hyperemia may be produced with the cup. This method has been used by all nations for various therapeutic purposes, to draw puss from wounds, abscesses and fistulas, the poison from the bite of animals, etc. It has been neglected and reintroduced from time to time, and has now secured a permanent place in the armamentarium of the physician and surgeon. It is as much used as it ever was to clean wounds and is now also widely employed to produce hyperemia. The most common form is a cup with a rubber ball at its end. Before use, the ball is partly or entirely compressed and the cup is placed upon the body—the rubber ball then distends, and exerting more or less suction, thins the air in the glass, according to the degree of evacuation obtained. Instead, a suction syringe connected with the cup may be used. Heating the air in a glass before placing it, is a method still in use by the laity. The apparatus must be thoroughly sterilized before use and this should be done by boiling. (Figure 4)

A number of forms have been constructed and can be found in the shop of every instrument maker to fit every portion of the body and to allow sterilization without spoiling the rubber ball.

That the cup actually produces hyperemia is proved by the red color of the skin when moderately used, which indicates an active or mixed form of hyperemia, and by the deep blue colors

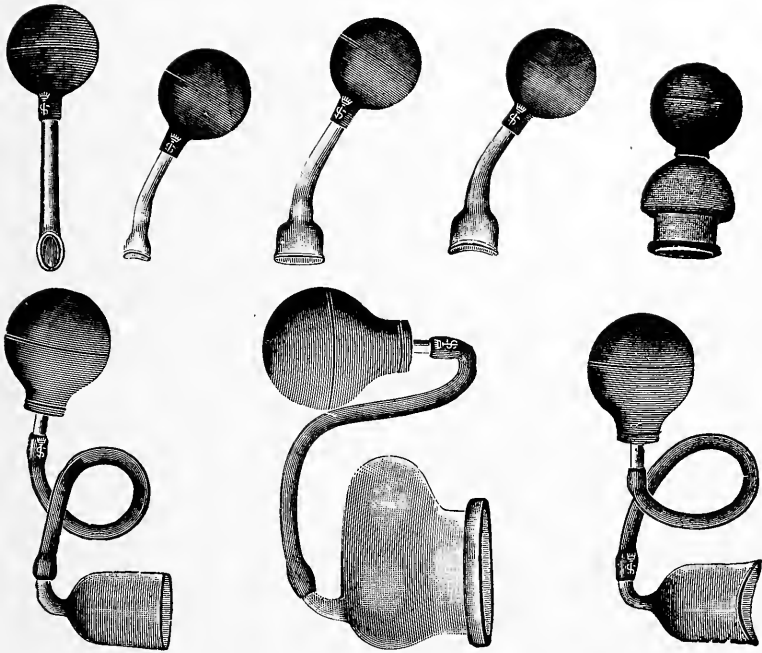


Figure 4—Suction Cups.

when the degree of evacuation of the cup is great, indicating a severe passive hyperemia. Bier has re-introduced and modified the apparatus employed by Junod and his followers since 1834. It consisted of large cups which are made of glass or tin, two in the form of boots, for legs and feet, and two cylinders, for arms and hands. After placing the extremity to be treated in the apparatus, the openings were tightly closed with rubber cuffs and evacuation produced with a suction pump. The apparatus was used in the treatment of a number of diseases, with the idea of freeing internal diseased organs from congestion and drawing the blood into the healthy arms and legs, and it was recommended in the treatment of internal hemorrhages, instead of the binding of the extremities in common use, to keep a large portion of the blood out of the trunk.

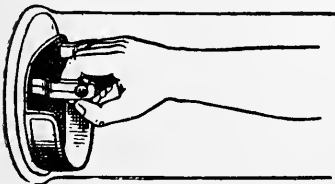


Figure 5—No. 1
Medium position for Stretching
the Wrist.

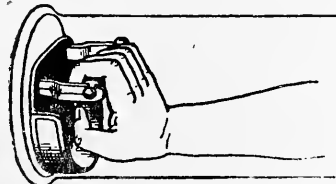


Figure 5—No. 2
Method of Stretching the Fingers
in the same manner.

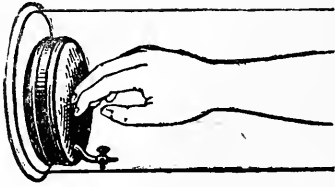


Figure 5—No. 3
Position of the hand against the elastic
resistance for bending the Fingers.



Figure 5—No. 4
Position of the hand against the elastic
resistance for bending the Fingers.

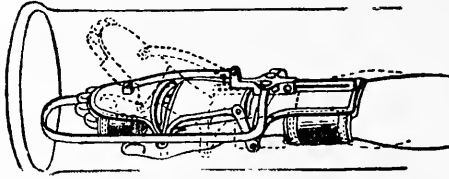


Figure 5—No. 5
Position of the hand for stretching the joints
of Fingers and Wrists by means of
auxiliary apparatus.

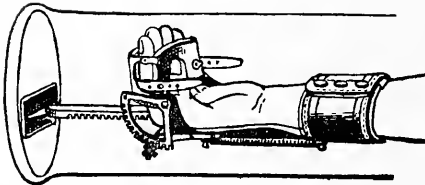


Figure 5—No. 6
Position of the hand when auxiliary apparatus
is introduced for stretching the
joints of the fingers.

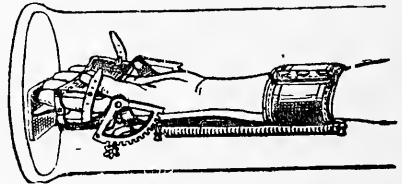


Figure 5—No. 7
Showing the hand stretched by
apparatus.

This apparatus has been introduced to produce hyperemia. (Fig. 3—Nos. 3 and 7). Large glass cylinders of forms to suit the purpose are used and closed air tight with a rubber cuff and rubber bandage not tightened enough to cause a hyperemia, after the affected member has been inserted. The air is then evacuated with a suction pump, until the desired effect is obtained. The degree of the hyperemia may be observed through the glass. Further evacuations are stopped for a few minutes, the air is allowed to enter and after a pause of from a few seconds to several minutes, the process is repeated, and the treatment continued from twenty minutes to half an hour at a time. The extremity is forced by atmospheric pressure into the vessel, and the patient has to counteract this, if it is not desirable to have the diseased member come in contact with the vessel walls.

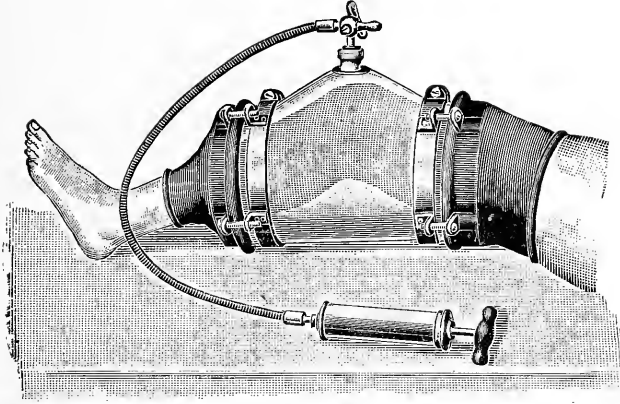


Figure 6—No. 1
Suction Apparatus for the Knee Joint. This illustration shows how knee, put into the tube in a stretched position, has become bent by the suction process.

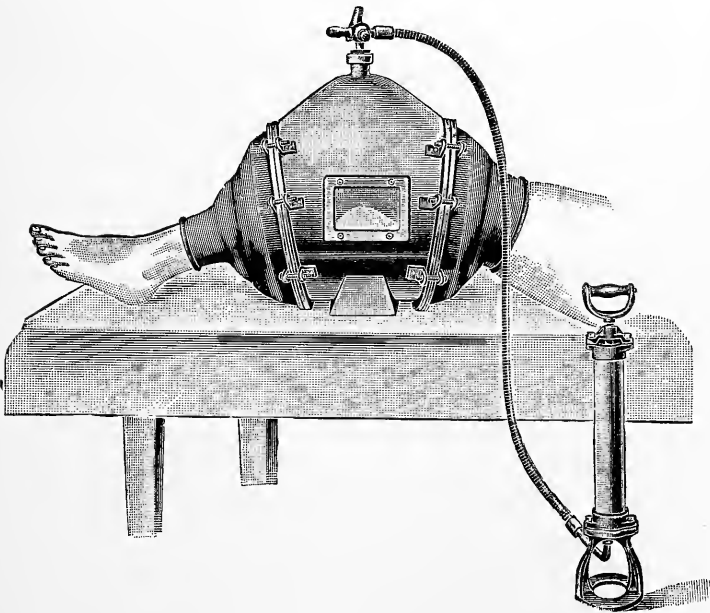


Figure 6—No. 2
Suction Apparatus for the Knee Joint, to obtain increased flexion, in connection with large pump.

To avoid a hyperemia of the whole extremity and to treat a certain portion alone, vessels open on both ends are used, through which the leg or arm is passed and the apparatus closed with rubber cuffs and bandages. (Fig. 6—Nos. 1 and 2). The glass is kept clean for observation by dusting it with soap powder before beginning the treatment. The hyperemia is passive, due to the action of the cuff, which pressing upon the enclosed armor leg, like a bandage, interferes with return flow of the blood. The immediate effect of the partial vacuum is widening of the capillaries and veins, lessening peripheral resistance and increasing the velocity of the blood current. Arterial hyperemia may be produced with this apparatus by using only a very moderate vacuum. The changes observed in the treated part are similar to those produced with a bandage. The apparatus is useful in the treatment and mobilization of stiffened joints.

The great force with which the atmosphere presses the extremity into the apparatus closed with rubber cuff and bandage and forces the hand against the bottom of the tube, is used for this purpose. A number of different instruments have been designed to treat every joint of the body.

This treatment is well borne by the patient, and as the accompanying hyperemia lessens pain it can be exceedingly well dosed. Any desired amount of pressure can be gently and uniformly applied. The treatment should be commenced and closed with a hyperemia that stops pain, saturates the tissues and dissolves morbid substances. Joints stiffened by trauma or rheumatism are best suited for this method of treatment.

Like the cup, the derivatives have been used since time immemorial. They are classified according to their action, to redden the skin, produce vesicles and pustules, or lead to suppuration, and just like cupping, their curative effect was thought to be due to their action in drawing blood and morbid secretions from diseased parts of the body.

Naumann showed with experiments on frogs and bats that irritation of the skin quickens the heartbeats, and increases the velocity of the blood current throughout the body. He amputated the hind leg of a decapitated frog, with the exception of the sciatic nerve, which was the only connection left with the body. He then irritated the skin of the leg with the faradic brush, and found that weak irritation quickens the heartbeats, and increases the velocity of the blood current throughout the body, and the strong irritation decreases the heartbeats and slows the blood

current. He concluded from these experiments, that the curative effect of the derivatives depend on a reflex act of the central nervous system and the effect upon the general circulation. Schuller, after trephining a rabbit, observed through the uninjured dura, that application of mustard to the back or abdomen of the animal, caused first a widening of the Pia vessels, then for several minutes constant changes in their calibre and finally contraction, lasting about one and a half hours, followed by a sinking of the brain. Amylnitrite affected the vessels but little during the time. Cold water applied anywhere to the surface of the body, caused contraction and hot applications widening of the Pia vessels. These findings correspond with Frank's statement that irritation of the surface causes widening of the capillaries accompanied by contraction of the Splanchnics. This shows that the central nervous system plays an important role in the production of a hyperemia and that the application of irritants to the skin causes circulatory changes by reflex-action. That this is not the only means by which the organism can protect itself, has been shown by others. Samuel's experiments are remarkable and are not explained as yet, though they do not disprove the observations made by Frank and others.

After irritating one ear of a rabbit with croton oil or burning it with hot water, Samuel could delay and prevent the inflammation by inserting the other ear or the extremities in cold water, even after cutting the sympathetic nerve of the injured ear and the auricularis major and minor of the cooled ear.

That irritation of the skin causes hyperemia, involving the deeper structures, subcutaneous tissues and muscles down to the bone, has been shown by experiments with tincture of iodine painted on the skin.

The curative effect of the derivatives is due to the hyperemia they produce. They stop pain, slow the blood current and dissolve morbid substances in the part of the body treated. The curative effect of the active cautery is just like the other derivatives due to the resulting hyperemia it produces.

Dosage is of importance—"slight irritation stimulates, moderate stimulation favors and strong and very strong, does harm".

Hot air, when applied not more than one or two hours per day, is a powerful absorbing agent and removes edema. If used for seven hours or more a day at temperature of 100 degrees C., it produces edema. Passive hyperemia stops pain when properly used, and causes severe pain and does serious harm when used to

excess. Just as any other remedy, its effect differs with each patient and what is strong for one may be slight or moderate for another. This has to be considered in its application.

HYPEREMIA IN DISEASE

Passive hyperemia is the supreme remedy in all the local infections. It imitates the inflammatory process of Nature. It widens the blood vessels, slows current, saturates the injured tissues with serum and causes an immigration of leucocytes. Hot applications have a curative effect on account of the property of diseased tissues to slow blood current, to widen the vessels and to retain the blood. Passive hyperemia acts best in infectious diseases and active hyperemia, best in non-infectious diseases. However, active hyperemia may act, when passive hyperemia has been found inefficient, especially in chronic infections.

Bier made his first experiments with passive hyperemia in the treatment of tuberculous joints, led by the observations of Farre, Travers and Louis, who found that stenosis of the pulmonary artery is invariably accompanied by pulmonary phthisis. This he thought due to the intense anemia that accompanies this condition. He was also guided by the findings of Rokitansky, that heart disease and spinal curvatures, producing hyperemia of the lungs, cause immunity against tuberculosis.

He was able to lay down certain rules for the treatment of these affections. *The hyperemia must never cause pain and should never be cold, that is, the treated joint must be at least as warm as the healthy—it is favorable if it grows hotter under the treatment, and the pulse must remain palpable.*

One hour every day is sufficient in most cases, though in exceptionally bad cases, two and three hours may be necessary. Edema is hardly ever produced in this way, though the affected joint swells. It is not necessary to apply the bandage close to the diseased joint, but it may be placed above the elbow when the wrist joint is affected.

If these rules are not closely observed, serious injury may be done, large abscesses may form and acute inflammation may be the consequence.

Sequesters are best removed by careful operation, gentle pressure, or by the suction of the cup.

If edema is produced, it has to be eliminated during the intervals of the treatment, by placing the extremity in a high position.

Cold small abscesses that may form are to be opened and gently pressed out. The openings must be small and done under strict antisepsis, and local anaesthesia. Pus may be removed with the cup. The little operation should be performed as early as possible.

Gentle movements of the joints should be permitted to prevent ankylosis. In affections of the knee and foot joints, the leg is enclosed in a split plaster-bandage, which has to be removed when the patient is in the recumbent posture, and has to be worn when he is in the upright posture. The bandage prevents the body weight from pressing upon the diseased joints. The whole procedure has to be gentle and the movements have to be made with caution, and in severe cases the treatment should be commenced in bed, and continued with supporting apparatus when the lower extremities are involved. When the disease is chronic, the treatment should be continued for nine months, or more, in most cases. A large number of cases have been reported, affecting every joint, with results far superior to those that could have been obtained by surgery. The aim of the treatment should be a well functioning joint, and if an operation promises more than this conservative treatment, it should be preferred. The knee joint has given the poorest results. The best results have been obtained with joints that react well. The affected part should become hot and appear irritated, occasionally blistered after the application of the bandage—giving the impression of an acute inflammation. Bier claims that this is the best, the most simple and the cheapest remedy, giving results far superior to the best operative treatment, though it is not infallible, and recourse must be had to operation when it fails. It is conservative and preserves and restores function to achylosed joints in a great number of cases. Cold abscesses that form under the treatment, when early recognized and opened are not harmful. Failures are mostly due to a faulty technic.

The treatment with passive hyperemia, produced with the cup, is recommended for tuberculous joints with cold abscesses and fistulas, which show a tendency to soften, whether or not glands, bones or other structures are involved. The cup made to fit the affected joints, is thoroughly sterilized by boiling and kept in bichloride of mercury solution of 1:1000. The skin around the diseased part is cleansed with benzine and then vaseline and lanoline in equal parts is applied. This has to be repeated after the application of the cup to avoid local infections. The cup is

removed after five minutes, for three minutes, and then again applied. The patients are treated daily until the granulations become hard and firm, then longer intervals have to be allowed between treatments and these have to be gradually lengthened, until finally the patients are treated only once a week. Cold abscesses must be opened. The hyperemia, which in acute cases should be very slight, may be stronger in tubercular disease. That is, the rubber ball compressed but little in the former, may be more strongly compressed in the latter, producing a greater vacuum in the cup.

Microscopic examinations have confirmed clinical experience, the increase and strengthening of vessels and tissues. The cases have to be well selected for this treatment—chronic edema has to be avoided and the treatment must be interrupted, if it has formed, until the edema has entirely disappeared. Application should not be made too frequent—that is, not oftener, than every second, third, or fourth day, according to the result obtained. These rules must be especially observed when the larger suction cups are used. Excellent results have also been obtained with passive hyperemia in the treatment of other structures affected with tuberculosis, such as testicles, bones, glands and skin affections, especially lupus.

To treat pulmonary tuberculosis, the apices have to be placed low by raising the foot-end of the bed, or by using large suction cups and hot applications. The inhalation of rarified air is also used to make the lungs hyperemic, and the treatment of patients at higher level is based upon this method. A very simple method is to close one nostril with the finger, inhale deeply and exhale through the mouth.

Acute inflammations and acute suppurations of the extremities, joint affections due to gonococci or other pathogenic microbes, freshly infected wounds and osteomyelitis, all have been treated successfully with passive hyperemia. The technic differs from that used in the treatment of tubercular disease. The bandage, not too loose, nor too tight, should be applied for twenty to twenty-two hours, and during the interval, the limb should be placed in a high position, to remove the intense edema that usually follows the treatment. Applications of shorter duration are rarely used and usually only in cases where a change of bandage, which should be made every eight to ten hours, is not possible, on account of the location of the disease.

The treatment should lessen pain, though it increases the symptoms of inflammation, redness, swelling and heat, the pulse must remain palpable, the venous return slowed and the arterial flow not interfered with. Patients with tender skin should have a gauze bandage applied below the rubber bandage, to avoid injury. Deep blueness of the treated part must be avoided, or if it appears, the bandage must be loosened at once. A thorough mastering of the technic and care and caution are necessary to treat patient with this method; without both, failure will be the consequence. To sum up, the treatment of tuberculous affections requires applications of short duration without edema, and the treatment of acute infections, long applications and large edema, which has to be removed during the intervals to give place for fresh serum.

Joints have to be moved in all cases to preserve and restore function. The sooner the treatment is commenced, the more favorable the prognoses. The suppression at the beginning of acute suppurative processes will be always the best field for this treatment. Abscesses must be opened in every case to remove pus. The time of the suppuration is shortened and tissues are kept alive that under the old treatment would have been subject to necrosis, notwithstanding, that in the beginning, pus and serum flow more freely from the wounds. Temperature is often lowered and not rarely drops to the normal as soon as the treatment is commenced, a sign that the cause of the infection has been destroyed by the hyperemia. In other cases this drop of temperature is only observed during the application of the bandage, due to partial destruction and delayed absorption of toxic substances. In others, temperature is but little or not at all influenced.

Excellent results have been obtained in the treatment of gonorrheal joint affections. Hyperemia is almost a specific in this otherwise most painful and troublesome disease which often ends in stiffening of the affected joints. The application should be long, from twenty to twenty-two hours, to get good results and as the pain rapidly lessens, movements must be commenced. Some rebellious cases are met with, in which treatment does not stop pain and may even increase it. In these the treatment should be commenced with a loose bandage and short duration, the time of application lengthened, and the tightening of the bandage gradually increased. With slow and cautious progress, success will finally follow. All acute infections of the joints are treated in the same way. Inflamed joints of acute inflammatory rheumatism appear also favorably influenced by the treatment though only used

in conjunction with internal medications. The first cases were reported by Leyden and Lazarus. Many other clinicians have used the treatment since.

Cases of suppurating joints have been cured, with perfect preservation of functions. If the knee joint is affected, rest in bed is necessary, until pain stops, when gentle movements have to be commenced to preserve function and to squeeze out pus, which flows freely from the openings. Only with this treatment are motions possible and permissible. It is best not to do any drainage or packing. The phlegmones of tendons of the fingers, which rarely give good results with the old method of treatment, are usually rapidly cured with hyperemia. The earlier the treatment is commenced the better will be the results. The abscess is opened with a few small incisions, pus is removed daily by gentle pressure, the wound, if necessary, washed with physiologic salt solution, well covered and the hyperemia treatment commenced. It is important to make daily passive movements with the fingers to preserve function. The movements have to be made after the removal of the bandage, during the intervals of treatment, to prevent bleeding. It is possible to abort the trouble entirely by this treatment, when commenced before pus has formed.

The technic of the treatment of acute and recurrent osteomyelitis and of all other acute inflammations and suppurations is the same. Furuncles, carbuncles and freshly infected wounds, are usually better treated with the cup.

I know from personal experience, as mentioned before, that passive hyperemia is useful in the treatment of affections of the head. I have worn the bandage around the neck for several weeks, with finally perfect results in mastoiditis, following grip. The pain, which was excruciating before the beginning of the treatment, not relieved by large doses of opiates, became bearable after the first application and gradually subsided. If the edema is too great, or the bandage gives too much trouble, or a choking sensation, it should be loosened for a while, or taken off entirely, to be again applied after the edema, which is far more rapid than on the extremities, has disappeared. Time of application is usually from eighteen to twenty-two hours, to vary as indicated in each case. With improvement, the intervals between treatment has to be lengthened and the treatment has to be continued for some time after recovery, to avoid relapse. In the treatment of suppurations of the middle ear, the drum has to be punctured, or the opening made larger, if already present—

large enough to permit free drainage. Small cuts are usually sufficient to allow the pus to drain off. The best results are obtained in the treatment of acute forms; the prognosis is good and results good, with perfect hearing restored. Careful technic and constant observation by the surgeon are necessary.

Bier has treated a few cases of cerebro spinal meningitis by this method. He observed in all a favorable influence upon subjective complaints, and, in one case, perfect results. He also reports a case of lymph ademitis, a few cases of parotitis and paralysis, all more or less, favorably influenced by this method of treatment. The same may be said of the result of the treatment of the affection of the mucus membrane of nose, throat and mouth.

In cases of diphtheria, serum injections have to be added. A cold can be cured in twenty-four hours when acute.

Acute local suppurations due to any cause are treated with the cup, which is daily applied for thirty to forty-five minutes, five minutes at a time, at intervals of three minutes.

A thick layer of vaseline and lanoline should be applied around the furuncle or carbuncle to prevent the spread of infection, and for the same reason, a thorough cleansing with benzine is necessary, before and after each application. The evacuation of air has to be slight, and the cup small. If this is not observed the treatment is painful.

Furuncles, carbuncles, buboes, cold abscesses, infected wounds, acute and chronic, and insect bites have been treated with good results. The opening of abscesses should be done under local anesthesia.

Diabetes mellitus is no contra-indication to this treatment, though the cure is not as rapid and a careful technic is especially indicated.

Fistulas, no matter where located, can be treated with the cup, and it has given good results in the treatment of acute puerperal mastitis. The technic for the treatment of puerperal mastitis differs little from that used in other cases, yet the details are of great importance. The diameter of the cup has to be from 2-4 c. m. smaller than the breast. The patient presses the instrument against the breast and holds it there during the treatment. With the gradual evacuation of the air the breast is drawn into the cup, its color appears crimson and the veins swell. The patient has a sensation as if it were going to burst. The process

should not cause pain. After evacuation from thirty to sixty C. M. of milk, a larger amount of pus and blood is drawn out to be followed by a red serous liquid. It is important to draw out all the milk.

Abscesses should be opened and the pus removed by suction, for which process a small cup may occasionally be used in conjunction with the large cup. Time and manner of application is the same as in other cases. The treatment with hyperemia removes milk and pus by suction, stops pain, destroys microbes, neutralizes toxins, absorbs morbid substances and cures with perfect function of the gland.

Chronically stiffened joints are always benefitted by treatment with hyperemia. In a large number of these cases, hot air treatment acts best, in others a combination with the bandage treatment and in some, especially in the weak, passive hyperemia alone should be used. Hot air treatment in chronic rheumatism and arthritis deformans is in daily use. As a rule, the treatment should not last over one hour and during this time several joints may be treated, one-half hour each. If the patients are strong and robust and a large number of joints are affected, the treatment may be extended to two hours per day, the joints of the legs treated in the morning by putting each leg one-half hour in the hot air apparatus, reaching to the middle of the thigh, and treating the arms in the same way in the afternoon.

This is, however, taxing and should not be used for such a length of time, except with strong patients. As mentioned, the treatment of one joint will cause improvement of others.

If a large number of joints are affected, the hot air treatment may be used for the knee, hips and shoulder joints, and passive hyperemia for the elbow, hand and fingers. The edema has to be removed by position and gentle massage, before each treatment. The results obtained are not brilliant.

Anchylosed joints due to trauma have been treated successfully with hyperemia. The hot air treatment gives good results. Stiffening of joints of the spine, in scoliosis and arthritis deformans may be treated with hot air, twenty minutes daily.

A number of other affections have been successfully treated with this method. The absorbing power of active hyperemia to remove chronic edemas and exudations and the treatment of elephantiasis, has given good results. Neuralgias are benefitted and cured by hot air treatment, etc.

There can be no doubt that Bier has shown by his ingenious and painstaking work, extending over many years, that hyperemia cures and that active hyperemia is needed for work and passive hyperemia for repair. *The internal diseases have to be treated with a combination of all therapeutic methods to bring blood to the diseased organs and tissues to produce an active or passive hyperemia as needed.*

CHAPTER X

VACCINE AND SERUM THERAPY

Substances prepared by the organism to defend itself against the invasion of bacteria are made use of in the treatment of infectious diseases.

Though it was long known that the body possesses protective powers against disease, and that one attack of an infection frequently conveys immunity against another, it was impossible to understand the complex phenomena of immunity and to treat the infectious diseases with immune sera, until it was proved that the infectious agents were micro-organisms that could be isolated on solid culture media.

This part of therapy is, therefore, new; yet a great deal of knowledge has been gained and complete success has been achieved with this method of treatment in diphtheria, and partial, but encouraging results, have been obtained in a number of other infectious diseases.

Three factors are necessary to cause an infection: A certain quantity of invading bacteria; a certain virulence, which these micro-organisms must possess, and a predisposition of the invaded animal, including man. Great virulence of the bacteria in a small quantity may cause a successful invasion, even when the predisposition of the animal is slight, and on the other hand, bacteria of slight virulence entering in large quantities may cause disease when the predisposition is favorable. The battle between the protective powers of the body commences as soon as bacteria have invaded it. Virulence upon which an infection so largely depends, is relative, and it may be diminished or increased. A passage of bacteria through animals allows only the most vigorous specimens to survive in the struggle for existence by means of protective powers of the body and kills off the weaklings. This process is usually employed to increase the virulence of the bacteria and is successful only if the suitable animals have been selected for this purpose—that is, those that have a certain predisposition, allowing the stronger bacteria to grow and to multiply. Animals without such a predisposition weaken and destroy the invaders. The resistance offered by bacteria in the

battle with the defences of the body is their virulence, which may be diminished by growing them on artificial culture media—a method that excludes a struggle for existence and the strength it gives to the survivors. The weakened resisting power of the body against an invasion of bacteria is its disposition; the defensive powers of the organism are insufficient to cope with the enemy, or they are temporarily lowered in quantity and strength.

An inherited resistance (immunity) an absence of a disposition towards certain diseases is found in certain animal species, and in certain races and individuals. Animals are not affected by measles and scarlet fever, and man not by "Rinderpest" and chicken cholera, and certain species are immune against certain infections. It may be observed in every epidemic that certain individuals contract a severe form of the disease, others a light form and many are not affected at all, though the exposure to the infection may have been the same. Such an inherited resistance is rarely absolute. The young often possess a predisposition for a certain disease absent in the adult, and causes that lower the general health of the body, lower its resisting power against disease and increase its disposition. Such causes are well known—chronic alcoholism, chronic organic disease, frequent childbirth, fright, worry, depression, etc. Local injury, for instance to a joint, determines often the localization of the infection and in certain cases may prove a protection, preventing general sepsis. Bacteria that, after entering the body, cause disease, are spoken of as pathogenic, a relative term only, as non-pathogenic bacteria may cause disease under certain favorable conditions, and those that are pathogenic for one animal species may be non-pathogenic for another. The lower animals are immune against syphilis and gonorrhea and dogs and goats are rarely affected with tuberculosis.

A differentiation has been made between the various infectious diseases. They are classified as diseases of infection and of intoxication. In the former the invading bacteria flood the organism, as in anthrax and cholera, and in the latter they remain principally at the seat of entrance, as in tetanus and diphtheria, where they excrete poisons, ectotoxins—that pass into the circulation, causing disease and death. The division line is not sharp, as the toxins contained in the bacteria of the former class and known as endotoxins, affect the body in the latter stages of the disease.

If the bacilli of diphtheria or tetanus are grown in bouillon for several weeks, then filtered, and the filtrate free of all micro-organisms, is injected in minimal quantities into animals, it will cause a complete symptom-complex of the disease. The ecto-toxins are products of secretion and excretion of the bacilli during life. Their chemical composition is not known. If on the other hand, the bacilli of cholera or plague are treated in the same way and intraperitoneal injections are made with the filtrate, they will prove harmless, whereas, the bacilli containing endotoxins are highly toxic, and when injected will cause the typical disease and sometimes death. The endotoxins are set free by the blood serum dissolving the bacilli.

Corresponding to the diseases of infection and of intoxication we speak of an immunity against the bacteria themselves and against toxins and either may be inherited or acquired.

The body possesses a large number of ingenious contrivances to defend itself against an invasion of bacteria. Skin and mucous membrane serve as protection. Though we carry constantly numberless pathogenic bacteria in the buccal and nasal cavities, which are removed with the secretions, an infection is not possible from these places as long as the mucous membrane is intact. The mucous covering the intestinal mucosa prevents bacteria from entering the body, and the ciliated epithelial cells lining the bronchi with outward brushing movement, do not permit micro-organisms to pass into the respiratory apparatus, and the whole digestive process—not special antiseptic properties of bile and hydrochloric acid, as has been maintained—serve as powerful and efficient protection against an invasion of bacteria. A healthy unbroken skin and mucous membrane and a sound digestive apparatus are the most efficient means of protection against the numberless pathogenic micro-organisms to which we are constantly exposed. As soon as bacteria have passed these barriers, the battle between them and the defensive forces of the body commences, though an inherited immunity, which in some cases may be due to unsuited culture media, an unfavorable soil furnished by the invaded organism will protect.

These protective forces are manifold and they are contained in the serum of the blood and its cells. Some of them, the lysines, unite with the microbes as fast as they enter and dissolve them. This takes place so quickly that we may not become aware of the danger that has passed. However, destruction and solution of bacteria sets toxins free, which if not neutralized and eliminated,

cause disease. Death following an infection is not due to multiplying bacteria, but is due to these toxins set free by their destruction and solution. So it may happen that an individual may die a sterile death, that is, all bacteria may have been destroyed, but the organism has not been able to neutralize and eliminate these poisons. As long as the battle between the body defences and the bacteria is fought, multiplication and destruction of bacteria corresponds. Not until victory has been decided against the body, do these micro-organisms multiply excessively, dangerous, only because they cannot be removed except by lysis.

Bucner called the substances in the blood-serum that have bacteriolytic and destructive properties "Alexines" substances of defence. Heating at a temperature of 55 degrees to 60 degrees C. destroys them, the serum being inactivated. Alexines act best at body temperature in a liquid of neutral or slightly alkaline reaction, containing salts.

The quantity of alexines contained in the serum is not constant. It varies in the normal, and still more so in the infected animals, and its regeneration does not cease until death. It is an important factor in natural immunity. The origin of alexines is not known, though it is thought by some that they are a product of secretion of the leucocytes—not to be confounded with leukines—not found in a normal serum, produced only by the leucocytes under the influence of certain infections, such as diphtheria bacilli, streptococci, pneumococci, etc., against which the alexines are powerless. Besides these bactericidal substances, others are contained in the blood serums that serve to prepare bacteria for phagocytosis and which have been called opsomines by Wright. They are of great importance in certain diseases, for instance—in diphtheria and tetanus, because they produce antitoxins which neutralize the toxins secreted by these bacilli, and which cannot exist and are dissolved, if the antitoxin is present in sufficient quantity. Some of the microbes may continue to grow locally without causing symptoms of disease, and their carriers, especially those of diphtheria and typhoid, may spread the infection. The normal blood serum contains a number of other substances, such as agglutinines, precipitines, etc., to assist in the defense of the organism against invading bacteria, and it was long thought that the blood serum with its defensive forces was the most important, if not the sole factor, of immunity.

Blood is represented in every organ and tissue of the body. It receives their secretions and flows to distant parts, passing into

every nook and corner and is best adapted to defend the organism against bacterial invasions. It is usually found sterile, and when infected it rapidly frees itself from micro-organisms. No matter how many bacteria may circulate in the blood during an infectious disease, they disappear with recovery. The faculty of the body to sterilize the blood and keep it sterile has been shown by injections of pure cultures into animals, which quickly disappear. Not all of them, however, are destroyed. Some are passed into and retained by the spleen, bone marrow, lymph glands, etc., where they may undergo destruction or cause disease.

In the beginning of the twentieth century, Metschnikoff advanced his famous theory of phagocytosis, which at once found favor and is popular today. Leucocytes enter into battle with the invading enemy and swallow the bacteria. If the leucocytes succeed it means recovery, and if the microbes are victorious, it means death. This theory was hotly contested and it was advanced that with the swallowing of the bacteria by the leucocytes, the battle does not always end—that not all are destroyed, but some continue to live within the cells, are carried by the blood stream, and can, under certain conditions, infect distant parts. This was especially shown in tuberculosis. Many other arguments brought forward, forced Metschnikoff to modify his theory, and it is now very generally accepted that both the serum and the phagocytes act to protect the body. If bacteria have entered the body, a large number of leucocytes, attracted by positive chemotaxis, flock to the point of danger, swallow the invaders and digest them. The more virulent forms have to be prepared by substances contained in the blood-serum before the leucocytes can succeed, and Wright called them opsonines from *opsono*, prepare and make digestible. If the mobility of the leucocytes is paralyzed by opium, it is possible to infect animals that possess natural immunity against the infection.

Phagocytosis is an important factor and not infrequently the most important in immunity, though the destruction and solution of bacteria by the serum must not be underestimated. If lysis takes place within the leucocytes, as it does in phagocytosis, the body is protected against the frightful poisonous effect the endotoxins exert, and phagocytosis is usually a favorable indication in the course of an infectious disease. It depends, however, on substances contained in the serum that cause positive chemotaxis. Small amounts of proteids derived from bacteriolysis favor it and large amounts cause negative chemotaxis, repel the leucocytes

and the quantity of immune bodies, amboceptors with which the leucocytes have loaded themselves. It is the whole blood that acts, not one particular kind of cell or substance and not one particular process.

Man and animals have a natural immunity against snake venoms and bacterial poisons when taken by mouth, which are highly toxic when subcutaneously injected, or become so, when entering the body through a wounded skin or mucous membrane. This has been proved in tetanus and diphtheria toxins and for tuberculine. These poisons are partly destroyed by the action of the digestive ferments in their passage through the gastro-intestinal canal, or pass through it unchanged without doing any harm. The natural immunity of man and animals against toxins is slight, though some possess such an immunity against certain poisons. The hog is immune against snake venom, rats against diphtheria and chickens against tetanus toxins, etc. This immunity is not absolute. Tetanus toxin injected into the brain of chickens will kill them and rats will be killed by the injection of diphtheria toxin into their brain. The resistance against poisons varies enormously in different animal species and the lethal dosage is exceedingly small in some; for example—1/200 of a drop of a strong tetanus toxin will kill a horse of a thousand pounds. The natural resistance of certain animals to certain toxins is not due to their destruction of antitoxins, as it was first thought. These animals do not produce antitoxin. When those immune against tetanus are injected with tetanus toxin, they will remain healthy, whereas, others will be killed when injected with the blood drawn from the injected immunes months after—the poisons are very slowly eliminated. The theory advanced by Behring, that the body cells possess an immunity against these toxins, has also been disproved. Ehrlich explains this resistance with his side chain theory. The cells do not possess receptors to anchor the toxins; they cannot unite with them and are, therefore, not injured.

As has been mentioned, immunity may be natural or acquired, and acquired immunity may be natural or artificially produced by vaccination. Measles, scarlet fever, small pox and cholera convey immunity to those that have passed through them, no matter whether the disease has been light or severe. Whereas, diphtheria, pneumonia, influenza and others do not produce immunity and erysipelas creates a predisposition for further attacks.

The resistance so acquired was early recognized and it was long the custom to expose children during light epidemics of measles, etc., to protect them from a severe infection, and the same method was used during epidemics of small pox. After the discovery of the specific infectious agents, vaccination with the weakened bacterial was used instead. The cause for this resistance against further infection has been found in the production of specific protective substances formed under the influence of the specific bacteria and their secretions.

Lysines, opsonines, agglutinines, precipitines, etc., protect against bacteria and antitoxines against their toxins. We have an immunity against bacteria and against toxins. Bacteria, as well as other foreign substances, introduced into the blood, for instance, the blood corpuscles of different animal species, ferments, etc., produce these anti-bodies and they themselves have, therefore, been appropriately called antigens. With the formation of antibodies an increased resistance of the natural protective forces of the body is the result—followed by a more active leucocytosis and an increase of alexines in the blood serum.

Ehrlich's sidechain theory explains the phenomena of immunity satisfactorily and has led to the discovery of new facts. It will stand as long as it does, and will fall with the discovery of a single fact that can not be explained by it. Ehrlich has based his theory upon chemical views. Similar to the benzol ring, he assumes an active cell body or nucleus, armed with a number of receptors or side chains that serve during life to select from the blood current molecules of food for the nutrition of the cell, bringing them in close contact with the cell body. Nutrition is then carried on by diffusion and dialysis. This arrangement of receptors explains the faculty of the cells to select the proper food, that is, to fix only molecules to which they have affinity—receptors. At the time when Ehrlich formulated his theory, it was known that the body protects itself against toxins by forming antitoxins to neutralize the toxins and that the blood serum containing these substances injected into a susceptible animal, would protect it against the disease; differing from the action of certain poisonous alkaloids, such as morphine, strychnine and others that introduced into the body do not produce antitoxines, though the cells gradually become accustomed to live in the body-juices containing them, forming a loose union. According to Ehrlich's theory, the toxin consists of two groups, which he calls haptophore and toxophore, of which the haptophore is anchored by a

suitable cell receptor, that is, only by one that fits to the haptophore group "like the key to the lock". The toxophore group brought in this way close to the cell can exert its poisonous effect, and may either injure or destroy. The injury serves as stimulation to repair, that is, in this case, new receptors are formed to replace those that have become useless to the cell. According to Weigert's law, an over compensation, overproduction of these receptors takes place, which are useless to cell life. They are thrown off. Circulating in the serum are the antitoxines. They have the capacity to fix the haptophore group of toxine and protect the body by combining with the toxine before it can be anchored by body cells that have suitable receptors. If injected into a susceptible animal, they act in the same way—they protect it against infection.



Toxophore
Haptophore
Cell



Toxophore
Haptophore
Antitoxine

An animal is immune against a certain toxine, if it has no receptors to unite with its haptophore group. Tetanus, injected into a turtle, does not affect it, the body cells having no receptors to fix the haptophore group of the tetanus toxine. It does not produce antitoxine and its blood serum will produce tetanus in susceptible animals. If on the other hand, an animal like the alligator, is injected with tetanus toxine, it produces antitoxine, without conveying the disease. This proves that its cells, though possessing receptors to fix the haptophore group of the toxine group, are resistant against the toxophore group.

The haptophore group, called toxoid by Ehrlich, when alone, is able to produce antitoxine. Toxoids may be produced through decomposition of the toxophore group by age, spontaneously, in solutions that contain toxine; they may be destroyed by heat, or chemical process, leaving the haptophore group intact, but non-poisonous. The thrown-off cell receptors neutralize the toxins by combining with them and act as antitoxines in the body that produces them, as well as in an organism into which they have been injected. Antitoxines, in the light of Ehrlich's theory, can only be produced by body cells that have receptors to bind the haptophore group. This does not mean, however, that a poisonous effect must be exerted upon the cell by this union and as a matter of fact, it has been shown that antitoxines are specially produced by cells not much affected by the toxic influence.

A given quantity of toxines is neutralized by a certain amount of antitoxines, following the law of constant proportions, that is, multiples of toxine are neutralized by multiples of antitoxine. If antitoxine is injected into an animal in which the toxin has been anchored to the cells, it is of no effect. In tetanus, it manifests itself after the symptoms have appeared and in diphtheria after the fourth or fifth day.

Antitoxines have been called by Ehrlich, receptors of the first order. Receptors thrown off after the injection of albuminous substances and bacteria that produce precipitines, agglutinines, etc., cause precipitation of albumin or agglutination of bacteria in vitro and are called receptors of the second order; they possess, like the former, a haptophore group and secondly, a fermentative group that causes precipitation, agglutination, etc. Receptors of the third order are thrown off after an injection of bacteria or cells, red blood corpuscles, spermatozoa, etc. They consist of two haptophore groups, and on that account have been called amboceptors. One of these groups unites with the receptors of the cell, and the other with the complement contained in every normal serum. This double union brings the latter in close contact with the cell and causes its destruction—its lysis. Anything injected into an animal and which causes the throwing off of receptors, has been called an antigen, and the receptors of the first, second and third order have been called antibodies, as a matter of convenience.

Wassermann has furnished experimental proof for the side-chain theory. It was known that tetanus toxine has special affinity to the nervous system and by injecting a mixture of it and an emulsion of brain substance of the guinea pig into this animal, he could show that this injection did not produce disease, being united with the brain substance. It was later shown that this affinity exists only between tetanus toxin and the gray matter of nerve substance. A similar injection with diphtheria toxin did not protect. It has no affinity for nerve cells. In order to prove the over-production of cell receptors, Wassermann injected a solution containing toxoids obtained from an originally very strong tetanus toxine solution that had been kept for eight years and through the action of light, etc., had become entirely non-toxic, though it was still able to bind tetanus antitoxine, thrust off receptors.

Injecting this solution into rabbits and following it in an hour with an injection of tetanus toxin, he had to increase the dose in order to kill the animal, as the cell receptors had united

with the toxoid. If, however, he injected the toxin several days after the toxoid injection, a smaller amount than the normal lethal dose was sufficient to kill the rabbit, due to an over-production of receptors. The serum of the rabbit injected with the toxoid solution did not contain antitoxine, showing that the receptors had not been thrown off, but remained sesile, and that the toxophore group is necessary to cause the production of antitoxine, the throwing off of receptors. Toxines are produced by certain bacilli—diphtheria, tetanus, dysentery—by certain plants—rizin, abrin, crotin—and by certain animals—snake venom, spider, scorpion, etc. They are very sensitive to heat, light and acids, resemble ferments and are especially characterized by their ability to produce antitoxines, when introduced into animal or man by injection or infection, after a period of incubation. This is not shared by morphine, strychnine and similar poisons, which form loose combinations with the body cells, with which they come in contact when circulating in the blood stream. The cells become accustomed to live in solutions containing them.

Antitoxines are probably proteid substances or closely related to them. Their chemical nature is still unknown. They act by neutralizing toxins, and do this within the organism and in vitro. Their action is specific, that is tetanus antitoxine will only neutralize tetanus toxin. They are easily destroyed by the effect of an exposure to heat, air, light and acids. The process of neutralization is of a purely chemical nature, as it may be produced outside the body and vital processes are thereby excluded. It has been compared with a salt, derived from the union of acid and alkali and as in this compound, either component may be set free; so after toxin and antitoxine have united and become indifferent, the toxin becomes again active, if the solution containing both is heated to 80 degrees C. destroying the antitoxine and leaving the toxin intact. As has been stated, this union follows the law of constant proportions, that is, a given quantity of antitoxins will neutralize a certain amount of toxins—the double quantity of the former will bind the double amount of the latter and the union is more rapid in concentrated than in diluted solutions. Ehrlich's theory explains the action of toxins and antitoxines.

Agglutinines are formed in the blood after an injection of living or dead bacilli, or when bacteria have entered it as an infection. They belong to the class of antibodies, that are produced by the organism to defend itself against an invasion of pathogenic

bacteria and are specific; that is, typhoid bacilli produce substances that agglutinate typhoid bacilli only, and cholera, plague, dysentery, etc., only those that will agglutinate them. The presence of the agglutinins shows the presence of the infectious agents. If a culture of typhoid bacilli or cholera vibrios is added to the serum of these patients, the bacilli lose their motility, form small clumps, which gradually become larger and larger and drop to the bottom of the test tube, leaving the formerly uniformly cloudy solution perfectly clear above them. The same process of clumping may be observed in a microscopic preparation. The specific action of the agglutinins is not absolute. Even normal serum will often agglutinate bacilli; however, they are present in larger quantities in the immune sera and will cause agglutination in great dilution. Typhoid bacilli will be agglutinated in a dilution of 1:5000. The purpose of the agglutination is not known, though Gruber thinks that the process injures the bacteria and aids in their destruction. Others have not been able to confirm this view. The bacteria live and multiply after agglutination.

If certain immune sera are inoculated with their specific bacteria, they grow in long threads and clumps. This is considered a phenomenon of agglutination and known as Pfaunders reaction. Loss of motility of the cells is no doubt an injury and likely aids in their destruction. The agglutinins differ in structure from the bacteriolysins, which only act in the presence of complement with which they have to combine before they can dissolve the bacteria and unlike these, they are not destroyed at a temperature between 50 degrees and 60 degrees C.

Ehrlich considers them receptors of the second order, with a haptophore and a zymophore group, which acts upon the bacteria and anchored by the former to the cell causes agglutination. Heating above 70 degrees C. and with long standing will form agglutinoids similar to the toxoids by destroying the zymophore group. These unite with the agglutinable substance, but do not cause clumping.

The agglutinins on account of their specific action are very extensively used for diagnostic purposes in various infectious diseases. Typhoid, cholera, dysentery, plague, meningitis, etc., and the reaction, known as Gruber-Widal, has proved of great importance in the diagnosis of typhoid fever. It appears during the first and second weeks and the blood of the patient preserves the agglutinating power years after recovery.

For microscopic examination a few drops of freshly drawn blood are put in a closed tube of narrow caliber and the serum is allowed to separate. A drop of it is then mixed with a drop of a bouillon culture of typhoid bacilli of twenty-four hours upon a slide. The clumping takes place in from twenty minutes to one-half hour. The macroscopic method may be used instead. A bouillon culture of typhoid bacilli will clear up, on account of the agglutinated bacilli, settling to the bottom of the tube. The microscopic test may be still more simply performed by allowing a drop of blood from the finger tip or lobe of ear of the patient to dry upon a clear glass slide. A loop of a twenty-four hour bouillon culture of typhoid bacilli is then placed on an absolutely clean coverglass, to which a large loop of watery solution of the dried blood is added. From this mixture a hanging drop preparation is made and examined with a 1-6 or 1-8 dry objective. If the patient suffers from typhoid fever, the bacilli will rapidly form clumps and lose their motility. Only a positive reaction is of value and it may indicate that the patient suffers from typhoid fever, or that he has had it previously during his life, even if he has not been aware of it, having passed through a very mild infection.

Some difficulty arises from what has been called group agglutination, the agglutination of closely related bacilli with the specific reaction. However, the difference of the quantity of the serum to produce the reaction is very great, for instance, typhoid bacilli are agglutinated with typhoid serum from 1:5000, far less, than is needed to agglutinate colon bacilli.

The reaction is only to be considered positive if the typhoid bacilli agglutinate in a dilution of 1:100 with the patient's serum; though it is safer to employ greater dilutions 1:500 or 1:1000. Castellani removes the obstacle of group agglutination by his absorption method. If, for instance, the serum of a patient greatly diluted agglutinates typhoid and para-typhoid bacilli, he adds to it a larger quantity of a bouillon culture of typhoid bacilli, allows it to settle, and centrifuges the mixture till the supernatant fluid is clear and ceases to agglutinate typhoid bacilli. then if the clear liquid, mixed with paratyphoid bacilli, agglutinates them, the infection consists of both bacilli. If it remains clear after mixture with the bouillon, the patient is infected with typhoid bacilli only.

This method allows the differentiation of meningococci and gonococci, which are both agglutinated in the same serum, and in the same dilution. Common receptors, according to Ehrlich,

explain the group reaction. The quantity of agglutinine contained in the serum does not seem to influence the course of the disease, patients with large quantities in the blood may die and others whose blood is poor in agglutinines, may recover.

Hemoagglutinines—substances that agglutinate red cells, may be developed by injecting animals with the blood of a different species. They are not destroyed by heating the serum to 60 degrees C. and similarly to the toxoids and bacterio-agglutinoids, they form agglutinoids which unite their haptophore group with the cells, but do not cause agglutination.

Hemoagglutinines are occasionally found in normal serum and goat serum. They agglutinate the red cells of man, pigeon or rabbit, each as specific. *Isoagglutinines* are formed if the red cells of the same species are used for injection to form them, and it is of importance to take this fact into consideration in the transfusion of blood, which will cause very serious trouble if these substances are present.

Bacteriolysines are produced with the agglutinines after an injection of bacteria, or after infection and a very small quantity of bacteria entering the circulation either way, causes the formation of large quantities of immune bodies, which protect the organism against an invasion of bacteria, by dissolving them. To prove this and to observe the process, a mixture of certain bacteria, for instance, cholera-spirilla, or typhoid bacilli, and the specific serum is injected into the peritoneal cavity of a guinea pig and drops of the exsudate are then taken with glass capillaries and examined. It will be observed that the bacteria lose their mobility almost instantaneously, swell, and break up in small round globules, which gradually disappear entirely from view. The animal survives. If the same bacteria are injected without the specific serum or with normal serum, they multiply in the exsudate and the guinea pig dies. The endotoxines set free during this process of bacterial destruction are intensely poisonous and if produced in larger quantities will kill the animal.

Bacteriolysines have been found in typhoid, cholera, dysentery and many other infections and though it is impossible to show their presence directly in all, as it has been done in typhoid and cholera, other methods have been devised to indirectly demonstrate their presence.

The bacteriolytic action of immune sera is specific, that is, cholera serum dissolves cholera spirilla, and typhoid serum,

typhoid bacilli only. This feature has been used for diagnostic purposes to determine the nature of an infection and for the identification of unknown bacteria. If, for instance, certain spirilla found in the excreta of a patient dissolve with cholera serum, the patient suffers from this disease, and if no solution of bacteria takes place, they are not the specific spirilla of cholera. Group reaction has to be avoided when using largely diluted sera. The same test may be used to show whether a patient has passed through such an infection previously. The specific serum is taken from an immunized animal and the bacteria from a culture made from the blood or excreta of the patient. Every cell, according to Wasserman, that is able to unite with the infectious agent or its derivatives may under certain conditions produce bacteriolysins. They are products of reaction and their formation by the organism is due to stimulation of its cells under certain conditions after the injection of bacteria. They lose their quality to dissolve bacilli after standing, or by heating the immune serum to 60 degrees C. though such a serum will still protect against the specific infection and regain its bactericidal power on addition of a small quantity of a normal serum. The serum, as it is called, is inactivated by heating and reactivated by an addition of normal serum. From this, it has been concluded that bacteriolysis is brought about by two definite substances, the one thermostable, called by Ehrlich immune body and later amboceptor, specific in its action and not destroyed by heating the serum to 55 degrees C., and a second one, thermolabile, destroyed by heating, non specific and contained in every normal serum—"Buchners Alexin" and Ehrlich's "Complement". The complement dissolves the bacteria and amboceptors couple them to the cells. The protective action of an immune serum against a bacterial invasion is due to the large amount of amboceptors it contains, as the quantity of complement is the same in a normal and in an immune serum. This explains the protection of an animal with an injection of inactivated serum, which finds the necessary complement to dissolve bacteria in the blood of the animal.

The amboceptor unites with the bacteria just as the antitoxine does with the toxine, though the process is not quite as simple. Antitoxic sera act best when administered in large doses, so as to neutralize all the toxine, whereas, a large dose of bactericidal sera may do harm. The amboceptors have two haptophore groups, one uniting with the bacteria and the other with the complement. If present in too large a quantity, they may be deflected,

that is, some may bind all the complement and others the bacteria, leaving the rest without this necessary substance for bacterial destruction and solution.

ABDERHALDEN'S PROTECTIVE FERMENTS

Abderhalden's discovery of specific ferments in the blood and his theory that these ferments are the working instruments with which the cells build up their structures and protect themselves from injury by foreign substances, is of great importance from a scientific point of view. It touches the problem of immunity of the cell itself, and promises to become of great diagnostic and therapeutic value.

Each cell has its own part to play in the economy of the organism and possesses its own special structure, chemical composition and functions. One only needs to compare a brain cell with a liver cell, a kidney cell with a cell of the thyroid, etc., to be forcibly impressed with this fact. There must be a certain protein in these cells differing from all others. To show that this is possible, Abderhalden states that if we change the places of twenty units about the number of the aminoacids, the end products of ferment action upon proteids, we get more than two billion of different definite compounds, and if we change the place of the elements in these compounds, we get numbers difficult to comprehend and yet the mixture remains the same in all.

Substances which are foreign to the cell are useless and must be broken up into simple compounds, which can be used by the cell. This is done by ferments. Pepsin attacks proteids in the foodstuff in the presence of hydrochloric acid, breaking them up to albumoses and peptones. The trypsin of the pancreatic juice further attacks them and finally the erepsin of the intestinal canal with the formation of peptides and aminoacids—the building stones of Abderhalden—are absorbed in the bloodstream and the cells take them according to their requirements. The liver exerts a protective influence, sifts the material and prevents undigested proteids from entering the circulation. It also controls the quantity of aminoacids entering the blood. The lymphatic system exerts a similar protective influence and prevents the entrance of bodycells into the circulation.

Ferments are substances that prepare and break down compound substances, fats polysacharides and proteids step by step, setting energy free, used by the cell to build up its structures from

the building stones, the end products of digestion. These vary with each organ and its cells—their composition is unknown—and we have to judge them by their action. They are more or less specific, and the more highly organized the organism, the more specific the ferments. Every cell has specific ferments and general ferments, common to others, and each cell is protected by a cell wall to prevent foreign substances from entering until they are broken up and have become harmonious. Certain micro-organisms assist in this process and frequently prepare the soil for others to live upon. Plants get nitrogen by the act of micro-organism and animals can use cellulose broken up by bacteria in the intestinal canal, so that it can be further worked down, and used by the intestinal glands.

The cells of the lining membrane of the intestinal canal are the only cells of the body that come in direct contact with the nutrient material. The infant uses mother's milk, harmonious to him—it is always the same mixture of salts, carbohydrates, fats and proteids, prepared by the mammary glands of the mother and when gradually a mixed diet is adopted, the cells have learned to break it up into "building stones". Digestion prevents the entering of material that is foreign to blood and body cells.

That cells have specific structures is demonstrated by the fact that certain cells form certain secretions, which act upon certain cells only, and that certain poisons attack certain cells, as shown in paresis, tabes dorsalis, tetanus, etc. This is of importance for therapeutic purposes; it must be possible to find medicaments which attack only certain cells.

The composition of the blood is constant and for all cells the same, due to the process of digestion, to the protective action of liver and lymphatic system and to constant secretions sent by the cells into the blood. It is a regulated process quantitative and qualitative. Every cell is responsible for the constancy of the blood, just as much as the gastro intestinal canal. If a cell sends a secretion into the blood not completely broken up, foreign to the plasma, it disturbs. This may happen when the specific ferment is absent.

Body cells can split fat into fatty acids, and glycogen over dextrose, into maltose, and maltose is split up by maltase into two molecules of grape sugar. It shows that cells possess ferments to break up these substances into building stones, and that every cell digests. Specific ferments protect the cells against an invasion of foreign substance—they are similar to the digestive

ferments. An invasion of foreign material into the bloodstream, bacteria, toxins, vegetable products, tissue or tissue contents of other animals, disturb the harmony, and the same happens when body cells change their structure, as they do in carcinoma and sarcoma, and become independent.

Foreign substances introduced into the blood by injection, or from the intestinal canal, cause the appearance of specific ferments to break them up, make them harmless and useful to the cells as building stores. The evidence of specific ferments against carbohydrates is lacking. This may be explained by the fact that the monosaccharids and disaccharids are rapidly eliminated, unchanged by the kidneys, and that, therefore, ferments are not needed to break them up, though after an intravenous injection of cane sugar invertin often appears within a quarter of an hour and sugar is broken up. If soluble starch is injected, it rapidly disappears, though no increase of the diastase in the blood can be detected, and if a large amount of fat is absorbed from the intestines, the fat splitting power of the blood is increased, the milky appearance of the blood rapidly fades with an accumulation of the resulting products in the serum. Carbohydrates and fats are always present in the blood—an increase of fat in the blood, increases its fat splitting power. If a large amount of egg albumin is fed to an animal, a ferment appears in the blood which digests egg albumin, and egg albumin only, and this ferment is not previously present. These ferments are not always strictly specific—they will digest other proteins as well as the one introduced.

After an injection of a certain proteid, or a certain mixture, not alone these are attacked, but the whole group. The organism reacts with a number of ferments to such complicated injections. The ferments can be inactivated by heating them to a temperature of 60 degrees C. for half an hour.

All observers agree that under certain conditions proteolytic ferments are found in increased amounts in the blood. These ferments, which have been called by Abderhalden "protective ferments" are probably produced by the leucocytes and red cells of the blood and by the bodycells themselves. If it can be shown that these ferments are specific and that the animal organism employs them for its defense, it indicates therapeutic measures. Micro-organisms may be injected and sera produced containing them. If albumin is injected into an animal, the ferments appear after twenty-four hours and if the injection is repeated after four

weeks, they appear much more rapidly. The cells have probably learned to produce the ferments quicker.

In pregnancy, chorionic villi enter the circulation and excite the formation of a specific ferment to digest these foreign substances. The serum of a pregnant woman should, therefore, digest placental tissue, and that it does, has been proven by Abderhalden himself, who reports five hundred cases examined with but a single failure. Though some observers disagree, a large majority have confirmed Abderhalden's results. The test is of value in extrauterine pregnancy, in myoma and pregnancy, and in other conditions.

The principle upon which the test is based, and which is undisputed, has been applied to the diagnosis of cancer, though with little success. Some have found a specific ferment, which digests cancer tissue, others have found non-specific ferments, while some have failed entirely. It is possible that it may be necessary to employ cells of a specific cancer-type to get results.

Very striking results have been obtained in the diseases of the ductless glands. A specific ferment is found in the serum of exophthalmic goiter patients capable of digesting exophthalmic goiter tissue, and similar results have been obtained in the diseases of the thymus, pituitary body, suprarenals, pancreas, ovaries and testicles.

If the test is applied to mental diseases, it has been found that in dementia praecox, the serum contains a ferment, which digests testicular and brain tissue and ovarian tissue in the female, and the serum of parietic patients digests brain tissue and of some of the patients the sex glands also.

The serum of patients suffering from millary tuberculosis digests tubercule bacilli, and that of scarlet fever patients, lymphoid tissue. The application of the test is without limit.

Abderhalden has devised two tests by means of which the chemical changes, which such ferments induce, are capable of detection outside the body—"polarization and dialization". The tests have to be employed by an experienced specialist in a well equipped laboratory.

Mackenzie Wallis states that only after eighteen months of patient work, he was able to obtain satisfactory results and Abderhalden demands that the investigator must get perfect results with the pregnancy test before attempting to solve other problems.

According to Metschnikoff, immunity is essentially due to phagocytosis and extracellular solution of the bacteria is but a

consequence of a previous decomposition of leucocytes. The view of Wolff Eisener that sensitized bacteria—that is—those that have united with immune bodies—are more readily swallowed by leucocytes, if they come in contact with them and bacteriolized, if they meet with complement, and that both processes of bacterial destruction and solution go hand in hand, seems to be correct. The partial failure of serumtherapy in infectious diseases is largely due to the fact that it is not possible to increase the amount of complement contained in the blood necessary for bacteriolysis, nor has a method been discovered to determine a proper dosage to prevent “deflection” and, finally, but few of the bacteria, situated mostly in the intestinal canal, as in typhoid fever and cholera, others again in the lymph glands—are reached by the blood. Antimeningococcus serum injected into the spinal canal has given good results, whereas, the same serum, subcutaneously injected, has been found of no value.

Hemolysins are formed after injection of red blood corpuscles of a different animal species and, like bacteriolysins, are, according to Ehrlich's views, amboceptors—that is, they act only in the presence of a complement. They dissolve the red cells, and the hemoglobin passes into the serum. Like the bacteriolysins, they act as coupling links between the red cells and the complement, so that the latter can exert its dissolving power upon the cell, being brought in close contact with it. They are specific substances, that is, if the red blood corpuscles of species (A), are injected into species (B), the serum of A, will acquire the power to dissolve the red cells of B, and of B only. This property can be transferred from animal to animal by injection of the specific serum, and a minute quantity of it is sufficient to cause the formation of a vast number of specific amboceptors. The hemolysins, like the bacteriolysins, possess group reaction—that is, a serum that will dissolve the red cells of man will also dissolve the red cells of monkeys, however, only in greater concentration. The serum is inactivated by heating it to 55 degrees C. It then loses its dissolving power, and is reactivated by adding to it a small quantity of normal serum, proving that it consists, like the bacteriolytic serum, of two substances, one thermostabile and the other thermolabile, the amboceptor and the complement, both necessary to dissolve the red blood corpuscle. Ehrlich called the specific substance amboceptor to indicate its two haptophore groups. Its union with the specific red cells is very firm and takes place at a temperature of 0. degrees C. Complement and ambo-

ceptor unite only at a higher temperature of 30 degrees C. and it is impossible to unite it directly with the red cells. It acts when coupled by way of complement, upon the cell, like a ferment and dissolves it—



Complement
Amboceptor
Red blood corpuscle



Illustrating
the action of
the amboceptor

The complement like the amboceptor consists of two groups, a complementophile group to unite with the specific body and a zytrophile group, which possess the dissolving power. Heating it to 55 degrees C. destroys the zytrophile group and leaves the complementophile group intact, similar to the toxoid group.

Bacteriolysins act like hemolysins by combining with the specific amboceptor. If for instance, a solution of bacteria is mixed and heated in an incubator with the immune serum containing the specific amboceptor and then centrifuged, it will be found that the superannuated, clear liquid, has lost its bacteriolytic power, and the amboceptors have united with the bacteria. Ehrlich's view regarding the union of amboceptor with complement and cell has been questioned. Bordet believes that the immune body injures the cell and thereby sensitizes it for the complement to act and to dissolve it. He calls the amboceptor "substance sensibilatrice" "sensibilicator". Gruber, whose theory is similar to this, assumes that the immune body prepares the cell, the red blood corpuscles and the bacteria for the dissolving action of the complement (Buchner's Alexins) and calls the immune body "preparator". Metchnikoff calls the same substance "fixateur" and thinks that the immune body unites with the bacteria so that they can be more readily swallowed and digested by the phagocytes. It is admitted by all observers that amboceptor and cell unite and that the complements possess the dissolving power. Ehrlich's theory explains the process well enough.

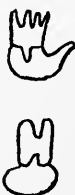
Normal serum acts bacteriolytic and hemolytic and an injection of bacteria or red blood corpuscles increases the dissolving powers of the blood serum, specific for the cells injected. The specific action of the serum is due to the amboceptors contained

in the serum, produced by overaction of the cells, replacing cell receptors and throwing them off as amboceptors. They are contained in every normal blood with the complement and are merely increased in number by the injection of cells. They are produced during normal metabolism and are constantly circulating in the blood. The view of most observers, though not unquestioned, is that a variety of amboceptors and complements is present in the blood.

If animals are injected with the red blood corpuscles of their own species, substances are formed that, like the hemolysins, possess the power to dissolve the red cells of animals of the same species, but not for all, however. These have been called isolysins. Autolysins cannot be produced. An isolysin will dissolve strongly the cells of one animal, slightly those of another one and not at all those of a third, etc. They are specific for certain animals only. They are amboceptors, consisting of two haptophore groups and act with the complement contained in the blood, dissolving the cell identical to the hemolysins. Moss states that in 25% of human adults isolysins may be produced, which is important in the transfusion of blood. The regulating function of the organism prevents the formation of autolysin, for instance, during absorption of large hemorrhages. Donath and Landsteiner found in serum of persons that suffer from paroxysmal hemoglobinuria, amboceptors that act when the blood is cooled to 0-15 degrees C. An injection of hemolysins into animals causes the formation of antibodies, antihemolysins, which may be either antihemolysins or anticomplements and which neutralize the action of the antigen that has caused their formation.




Complement
Immune Body
Cell





Complement
Anti-complement
Immune body
Cell
(After Levaditi)


Experiments to increase the amount of complement in the blood have not been successful. Bacteriolysis and hemolysis are also important for diagnostic purposes; for instance, a culture of typhoid bacilli is mixed with the specific typhoid serum, inactivated, heated to 55 degrees C. and fresh normal serum of a guinea

pig is added, solution of the bacilli is the consequence, this process is not visible. If on the other hand, an emulsion of the red cells of a sheep is mixed with the inactivated specific serum, obtained from a rabbit immunized with sheep blood, and fresh serum of a guinea pig is added, hemolysis, that is, solution of the red blood corpuscles of the sheep, takes place on heating the mixture in an incubator, the liquid becomes clear. If the serum of a patient suspected of typhoid is used instead of the typhoid serum and both systems are mixed and heated in an incubator, the red cells of the sheep will not be dissolved—the mixture will remain opaque if the patient suffers from typhoid fever. The complement contained in the guinea pig serum has been used for the solution of the bacilli and nothing is left to complete hemolysis. If the patient suffers from some other disease, the complement will combine with the specific sheep blood amboceptor and cause hemolysis, solution of the red cells and clearing of the emulsion. This process is spoken of as the Bordet Gengou phenomom.

I  Typhoid bacilli emulsion.

Ia  Emulsion of red blood corpuscles of sheep


II  Amboceptor against typhoid bacilli. Specific serum


IIa  Amboceptors against red blood corpuscles of sheep. Specific serum.

III  Complement Guinea pig serum

I 
II
III

Solution opaque

Ia  Sheep corpuscles not dissolved


IIa  Liquid opaque


Patient has positive typhoid reaction.

I  Not typhoid

Ia  Sheep corpuscles dissolved

II  Solution clear

IIa  Liquid has cleared

III  Patient free of typhoid; reaction negative

Wassermann applied the principles of this test to the diagnosis of syphilis. It was impossible to use pure cultures of the spirochete pallidum, the specific of lues, as was done by Bordet Gengou in typhoid. He employed instead an extract made of the liver of a syphilitic foetus, very rich in these micro-organisms, not changing the test of these investigators in any other way. The presence of hemolysis indicated that spirochetes antibodies (serum of the suspected patient) and complement had not combined, leaving the complement (serum of the guinea pig) to dissolve the red blood corpuscles of the sheep, in combination with the specific serum against these cells, diagnosis negative. On the other hand, the absence of hemolysis, its inhibition, indicated the perfect union of spirochetes, serum X (suspected patient) and complement; diagnosis positive. The serum to be examined may be either taken from the blood or spinal canal.

Later on, it was shown that the test could be made by using extract of non-syphilitic organs, liver, heart, etc., and though this proves that the specific extract used by Wassermann does not act like the bacilli in Bordet's test, it does not effect its reliability for diagnostic purposes. In practically every instance, the test made with surely non-syphilitic serum for control has given negative results, and of the surely syphilitic cases tested, above 90% have been found positive and in cases of latent syphilis, without manifestation, about 50% react positive.

A number of modifications of the test have since been made, using the red blood corpuscle of human blood, as indicator. The test gives, as a rule, results only after the primary lesion has been developed, previous however, to secondary symptoms. It is positive when these and the later symptoms of the disease have appeared and may remain so for decades after complete disappearance of all.

A positive reaction proves syphilis, a negative only the probable absence of it. A negative test may become positive later. It does not always indicate a cure. Fresh malaria, lepra foomboesia, recurrent fever and scarlet fever, may give, in rare cases, a positive reaction with the test and this has to be remembered when employing it.

Koch's tuberculin reaction and the Von Pirquet skin test are practical applications of this method of Serum Diagnosis. The injection of tuberculin into patients suffering from tuberculosis, binds specific amboceptors and sets toxic substances free, producing the characteristic symptoms of the reaction.

Cytolysins are produced similarly to the bacteriolysins and hemolysins formed after injection of bacteria and red blood corpuscles. Their formation is caused by an injection of various animal cells and as they often only injure the body cells and do not dissolve them, they are also called cytotoxins. A large number of these substances have been produced, analogous to the hemolysins, specific for the injected cells and for the animal species treated, such as nephrotoxin, hepatotoxin, neurotoxin, spermatotoxin, etc.

Metschnikoff injected guinea pigs with mesenteric glands and bone marrow and produced a serum with solvent powers for the white blood corpuscles of guinea pigs, which he called "neurotoxin", a very poisonous substance that kills the animals in a few hours. Landsteiner, Metschnikoff and Morten produced a spermatoxin in the same way, which destroys the spermatozoa of the animal species used for injection, etc.

Cytolysins, like hemolysins, consist of amboceptor and complement and when injected cause the formation of anticytotoxins that protect the animals against the toxic effect of these substances, similar to the isolysins, isocytotoxins can be produced. Metschnikoff injected guinea pig spermatozoa into guinea pigs, producing isospermatotoxin that killed the spermatozoa of other guinea pigs, leaving those of the treated animal intact.

Antiepithelialtoxin has been tried quite extensively by various investigators in the treatment of carcinoma. The results have not been encouraging.

Opsonins, discovered by Wright, and independently by Neufeld and Rimpan, who called them bacteriotropins, are substances that unite with pathogenic bacteria, preparing them for phagocytosis. The functions of the leucocytes are to devour and digest bacteria.

If an emulsion of highly virulent micro-organism is injected into a susceptible animal, the leucocytes are repelled, multiply and cause the death of the animal. If, however, the animal is first treated with the specific immune serum, the leucocytes swallow and digest the bacteria. Their activity is due to the opsonins which like bacteriolysins are contained in normal as well as in immune serum. They are specific and resemble agglutinins in structure, consisting, according to Ehrlich, of two groups, a haptophore and an opsoniferous group. Heating destroys the latter, leaving the former intact and it is impossible to reactivate the serum by an addition of complement. Wright uses this

opsonic action of the serum for diagnostic purposes and as a control of vaccinations, for therapeutic purposes. An emulsion of leucocytes is mixed with the serum of the patient and an emulsion of the specific bacteria, and stained. Preparations made from it have been kept for some time in an incubator. The phagocytic index is then determined by counting the bacteria contained in one hundred leucocytes and taking the average for each. The opsonic index is obtained by dividing the phagocytic index of the patient with the phagocytic index of a healthy person obtained in the same way. The patient is free from disease if the opsonic index remains normal. In chronic local infectious diseases, as tuberculosis, staphylococci and streptococci infections, it is mostly depressed, and in general bacterial infections, changing sometimes below and sometimes above the normal. The principal of a determination of the opsonic index is simple, the technique difficult. Wright uses determination of the opsonic index to control the treatment of bacterial infections by means of active immunization. Injections of cultures of dead bacilli in normal salt solution increase immunity and the opsonic index. Such an injection is first followed by a drop of the opsonic index—the negative phase—and this is followed by a rise of the index, the positive phase, if the dosage is correct, and a continuation of the negative phase if the dosage has been selected too large or too small. The size of the dosage depends on the reacting power of the patient. According to the published reports, the method gives good results in the treatment of the chronic infectious diseases, especially in tuberculosis, acne, and boils.

The execution of the method is difficult. The results are not exact and often do not correspond to the course of the disease. Some patients do well with a low opsonic index and others do not improve with a high opsonic index. It has to be remembered, that opsonins are but one of the many defenses the organism possesses against bacterial invasion, and that a determination of the opsonic index cannot measure its resisting power.

On this account and on account of the difficult technique and because the results cannot be used for prognostic purposes, it has never found general favor, though in the hands of the expert the method is often useful.

Agressins. It is well known that a patient may recover from a disease and still be a carrier of the infectious agent for many years. The serum of an individual who has recovered from typhoid fever may energetically kill typhoid bacilli, though these

micro-organisms may be constantly found in his stools, etc. The bacteria acquire immunity against the body defences. Anthrax bacilli form capsules, and encapsulated bacilli resist phagocytosis and the lytic action of the serum. Ehrlich succeeded in producing bacteria that resist the action of atoxyl and fuxin by repeated injection of these toxins. Bacteria after entering the body develop protective properties in the struggle for existence with the defences of the organism, which allow them to live in the body juices. They acquire immunity. According to Bail, bacteria form aggressive substances that paralyze the defenses of the body and he succeeded in immunizing with these substances, which he called "aggressins", against infections. They cause negative hemotaxis, suppress phagocytosis and if an animal is injected with a culture of bacilli, they convert the bacilli into virulent forms and cause death of the treated animal. He obtained aggressins by filtering exudates caused by bacterial infections. It is now, however, generally accepted that these substances are toxin and endotoxins contained in these fluids and that antitoxins can be produced that neutralize them. Similar to the formation of antitoxins, antiferments are formed, after injections of ferments, that neutralize the action of these, such as antilab, antipepsin, antitrepsin, antisteapsin, etc. They are substances destroyed by heating the serum to 60 degrees C. These antiferments have been recently employed for therapeutic purposes.

Precipitins are antibodies produced by the injection of a solution of bacterial or animal albumin. For instance, if the serum of an animal immunized against typhoid is mixed with the clear liquid of a bouillon culture of typhoid bacilli, freed by filtration from bacteria, a precipitate is formed.

Plague and cholera sera give the same reaction under the same conditions. The reaction is not produced by mixing the specific filtrate with normal serum. If, instead of the specific immune serum, the serum of an animal that has been injected with the albuminous solution of another animal species is used, a precipitate is formed on mixing it with the serum of the same animal.

Tchistocowitch observed that the serum of rabbits, treated with the serum of horses or eels, would produce a precipitate on mixing it with horse or eel serum and Bordet obtained the same reaction with the serum of rabbits injected with chicken serum. The clear mixture of serum and antiserum becomes cloudy, flakes

form and sink to the bottom of the tube as a heavy precipitate. It was further shown that the organism reacts with the formation of these specific antibodies, after injection of many other albuminous substances different in structure from its own albumin. Borde, Fish and other investigators, by injecting cow's milk into rabbits, produced a precipitate on mixing cow's milk with serum taken from these rabbits, which they called "lactoserum". Others used egg albumen and various other albuminous solutions with the same result. The specificity of the precipitins depends on the concentration of the serum. They give group reactions, analogous to the agglutinins and hemolysins. If human blood has been injected, the reaction is pronounced with human serum and marked with the serum of the Orang-Outang and Chimpanzee (the antropoid apes) and less so with the serum of other monkeys and still less, and only in high concentration, with the serum of all other mammalia.

The precipitines are destroyed by heating the serum containing them to 70 degrees C. and it cannot be reactivated by adding to it normal serum. According to Ehrlich, precipitins are receptors of the second order. They consist of a thermo stabile and a precipitating group, and have been used largely for diagnostic purposes. The reaction permits us to distinguish different albumins, important for practical purposes. For instance, if blood is found on cloth, wood or metal, no matter how old, the spot is dissolved in normal salt solution and the solution treated with human precipitin and human antiserum, a resulting precipitate indicates that the spot consists of human blood.

The antihuman serum is obtained by injecting a rabbit several times with human serum subcutaneously, intravenously, or intraperitoneally in gradually decreasing doses. The titre is determined after three injections. The serum is then taken by cutting the throat of the animal and allowing the blood to flow into a sterilized vessel and after immediately covering it, the serum is allowed to separate, and to collect above the clot. This is then taken with a pipet, sterilized tubes filled and kept in a cool place for the test, which is far more delicate than the chemical tests formerly in use. Stern reports a reaction with a blood diluted 50,000 times. The test is of the greatest importance in forensic medicine and can be used to detect the adulteration of sausage with dog and horse meat. It is based upon the property of precipitins to form the precipitate only with the serum that has produced them. Every animal species has its own individual

serum and any different albumin injected subcutaneously, intravenously, or intraperitoneally causes the formation of antibodies. This is entirely different when the albumin is taken by mouth. The gastro-intestinal digestion changes it, so that it loses its specific individuality. It is then absorbed to form the basis of the serum, specific of the animal species and of the animal. It is possible, that in disease of the gastro-intestinal tract, especially when larger quantities of albuminous substances are used in the form of egg, milk and meat, small quantities of such albumin may be absorbed unchanged and cause the formation of antibodies and a more or less serious intoxication. The main difference between mother's milk and cow's milk consists in the specific difference of the albumin, and the frequently unsatisfactory feeding of infants with cow's milk is due to the great task imposed upon the digestive apparatus of the infant to make it suitable for absorption.

Wolff-Eisener thinks, that the so-called idiosyncrasies, like urticaria after the ingestion of fish, crabs, lobsters, etc., are probably due to the absorption of small quantities of unchanged albumin, in consequence of an insufficiency of the intestinal tract to convert them into body albumin.

If animals are injected with precipitins, for instance, with lactoserum, antiprecipitins are formed that neutralize the precipitins.

Snake venoms are complicated substances varying in toxicity according to their composition. They consist of haemoglutinins, hemolysins, hemorrhagins and neurotoxins, in varying proportions. They are rapidly absorbed and their toxic action is almost immediate. They are, according to Ehrlich's theory, amboceptors. They can be inactivated by heat and reactivated by an addition of normal serum.

Antivenins are produced by injecting an animal with gradually increasing doses of the serum, commencing with a very minute quantity. Antivenins are now largely used for therapeutic purposes in India and in South American countries.

Anaphylaxis. This term has been introduced by Richet for an acquired hyperirritability of an animal, toward a subsequent injection of an albuminous substance. It means defencelessness and is used in contra-distinction to prophylaxis. Richet found in his experiments made with Congestin in 1894 that repeated injections did not immunize the animals, but made them more susceptible, causing vomiting, diarrhea, hemi and paraplegia and dyspnoea, ending in complete prostration, and Arthur, in 1903.

showed that rabbits, injected with horse serum, became very susceptible to a subsequent injection, leading to similar severe symptoms and frequently to death. The reaction is most decided when the first injection is made intraperitoneally, followed by a small intravenous injection of the serum in from fourteen to twenty-one days. It is specific, that is, animals injected with horse serum become hypersensitive only against this serum and it can be produced with any other albuminous substance, animal or vegetable. It is possible to sensitize an animal to several proteids simultaneously. Guinea pigs are especially susceptible. If injected with a mixture of diphtheria serum and diphtheria antitoxin, followed by a subsequent injection in fourteen days of a small quantity of normal horse serum, they will die. Animals that have recovered from an attack, may acquire immunity against further injections and those that have been treated with repeated comparatively large doses during the time of incubation may remain healthy when an injection is given fourteen days after the first. This state of immunity is called antianaphylaxis, returning frequently to the state of hyperirritability. Anaphylaxis can be produced with an injection of every alien-proteid to the animal—it appears after a certain time of incubation and repetition of the injection. The symptoms of the hyperirritability—dyspnoea, diarrhoea, vomiting, clonic and tonic convulsions may be so severe, as to cause death and may appear within a few minutes after the injection. The reaction depends on the toxicity of the proteid and on the quantity injected, as well as on the individual susceptibility of the animal. The hypersusceptibility may be transmitted to the offspring and may be transferred from animal to animal by injecting some of the serum of the sensitized animal into the normal, “passive anaphylaxis”. Serumsickness is a type of anaphylaxis and differs little from an infectious disease. Fever, skin eruptions, glandular swelling, albuminuria, leucopenia, joint symptoms and edema are its prominent symptoms. A predisposition of the individual is necessary to produce it. Not everybody acquires it and not everybody gets it with the same severity. A very large initial dose may cause it, or repeated small doses, provided that the injections are given at least eight to ten days apart, corresponding to the time of incubation of the serumsickness. The disease is not always without danger. Collapse and death has been reported following it, though this is rare in man, because the injections are made within the time of incubation, ten days. Old

serum is less dangerous than fresh serum and a subsequent injection is best made with highly concentrated serum in order to avoid the injection of a larger quantity of proteids.

Individuals with vasomotor irritability are especially susceptible and Wolff-Eisener believes that all the symptoms of anaphylaxis are due to irritation of vasomotor-centers. The dilation of the capillaries and the sudden drop of temperature, the dilated capillaries found in the lungs when the animal has died and the rapid disappearance of all symptoms when it recovers, support his view. Schultz and others, on the other hand, claim that anaphylaxis is essentially a hypersensitization of smooth muscles generally. They support their view with the tetanic contraction of the bronchial muscles including the lumina or the smaller bronchi and the asphyxia produced by it during the anaphylactic shock. In white mice the reactions are shown by increased intestinal peristalsis, contraction of the bladder, increased irritability of the skin, etc.

Anaphylaxis is produced only by injection of alien-proteid that acts as antigen, causing the formation of antibodies, which combining with the antigen in the presence of complement, produce toxins—the cause of the disease. This theory explains satisfactorily the time of incubation needed to form antibodies. Doerer, Friedberger, Russ and others, think that a close relationship exists between anaphylaxis and the precipitin reaction, that is, the anaphylactogen and the specific antibodies are identical with the precipitinogen and precipitin, and that their union in the presence of complement produce the toxic substances that cause the anaphylactic shock. Wolff-Eisener thinks the phenomenon of anaphylaxis is due to the absorption of toxic substances produced by lysis of the only apparently dissolved proteids.

SERUM AND VACCINE IN DISEASE

Since the discovery that the infectious diseases were caused by an invasion of pathogenic bacteria, close attention has been paid to the study of the defenses of the infected body against these micro-organisms and the protective forces were found to be contained in the blood and to be carried by the blood stream to the threatened parts. Efforts were then made to create specific immunity against certain infectious diseases, with more or less success, and various methods were devised to produce immunity against a single disease.

Active immunization consists in an artificially produced mild infection with living bacteria, or their toxins, with dead bacteria, or with a mixture of toxin and antitoxin, so prepared that the toxin is in slight excess, in order to stimulate the organism to self-defense by the formation of the specific protective substances. The infection with virulent living bacteria, formerly largely used, has been completely abandoned on account of the danger associated with it, since the introduction of better methods. It was common to expose children to measles during a light epidemic to produce an effective immunity against severe forms and Lady Montague introduced from the Orient the custom of variolation, to inoculate with a little smallpox virus for the same purpose. In 1796, Jenner showed that immunity against smallpox could be produced by an inoculation of cowpox, free from danger. This method has been used ever since and has become an obligatory measure in many countries, freeing the communities from this dreaded disease. In a similar way living bacteria may be inoculated in unfavorable locations for their growth. Cholera bacilli injected subcutaneously or intravenously, will produce a certain degree of immunity without danger. The seat of this disease is the gastro-intestinal canal.

An inoculation, just like an infection, is followed by a time of incubation lasting from five to ten days, during which time the organism produces the protective substances, due to the stimulation of the bodycells by the infectious agent or its toxins. This, known as the negative phase, is usually characterized by lessened resistance against infection. The immunity lasts several months or years, because the protective substances form parts of the cells and the organism has learned to produce them. The most minute infection may be sufficient to produce rapidly large quantities of antibodies after the organism has passed through the disease and the body may possess immunity though no antibodies are present in the blood. This has been experimentally proved and it is a matter of everyday experience. The bodycells have acquired the capacity to react to the specific stimulation with greater rapidity and to produce the protective substances in large quantities. The method is now used to protect the body even after infection has taken place.

Active immunization with attenuated cultures is one widely used. Various procedures may be employed to lessen the virulence of bacteria: they may be dried or grown at high or low temperatures, by passing them through animals little susceptible

to the specific infection, or by adding chemicals. The vaccination with the virus of cowpox against smallpox is based upon the method to attenuate bacteria by passing them through animals. Pasteur vaccines against Anthrax are obtained by growing the bacilli at temperatures unsuited to their growth, and dried bacteria are used in hydrophobia for vaccination.

The method of inoculation with dead bacilli is less dangerous and, therefore, preferable. Unfortunately, active immunization does not always produce absolute protection. For instance—streptococcus infections differ and it is impossible to immunize against all the various forms of streptococci, and subcutaneous inoculation protects frequently only against subcutaneous infections, but not against an infection proceeding from the gastrointestinal canal, etc. According to Ehrlich, an animal possesses natural immunity when it has no suitable receptors, or when it has them only in organs that cannot be injured by the toxins. It is relatively immune when it has these receptors in various organs that may or may not be affected by the poison. The result then depends on the manner of application. If the organism possesses the receptors only in organs that are readily injured, it is highly sensitive to infection.

According to Wolff-Eisener, no tissue of the body is absolutely nonsensitive against these toxins. Five Mgm of tuberculin injected will cause symptoms of depression and fever, and when inoculated into the skin will produce a local reaction.

Active immunization will not protect, if the serum does not reach at all or in insufficient quantity, or not rapidly enough, the seat of bacterial growth or if the intermediate sessil and mobile receptors are not able to prevent the toxins from reaching vital organs. Animals are protected against tetanus infection by sessil receptors when the toxin is subcutaneously injected, but not when intracerebral injections have been used. Active immunization is employed against smallpox, plague, cholera and typhoid fever and though for the reasons mentioned the protection is not absolute, it is the best that can be had at the present. After infection has taken place, it is used in tuberculosis when the process is localized. The method is contraindicated in all cases of general sepsis, in which the organism is flooded with poison and in consequence unable to produce protective substances in sufficient quantity. An injection of the virus can only increase the damage in these cases. On the other hand, in localized disease where frequently on account of the situation, the blood

supply and the formation of antibodies is insufficient, such as in furuncles, acne, localized abscess, cystitis, cholecystitis, etc., active immunization with the specific infectious agent has given favorable results.

Passive immunization—the treatment with immune sera—is ideal. The antibodies, contained in the serum are harmless. They do not injure the bodycells, but uniting with the toxins, neutralize them. Their action is specific and directed against the specific toxins. Unfortunately, they will not affect the toxins when anchored to the cells of the organism, though it is thought, that very large quantities injected will disrupt this union if not firmly established. The injection has, therefore, to be made at the very earliest time, and fails frequently in tetanus, in which disease, the symptoms appear after a union of toxins and body cells has been established. In diphtheria, the treatment fails for the same reason, when the injection is given after the fourth and fifth day. Unfortunately the antitoxins cannot be isolated and must be administered with alien-proteid horse serum, which may, though rarely does, cause serum disease. The immunity produced is immediate, but of short duration, as foreign substances are injected, which are rapidly eliminated. The injection with diphtheria and tetanus antitoxin are constantly used as prophylactic measures, in epidemics as diphtheria and in suspicious wounds against tetanus infection. The immunity is not lasting.

A third form of immunity is locally established at the seat of bacterial growth, which changes the tissues to such an extent, that they become nonsensitive to the bacilli and their toxins. Diphtheria and typhoid bacilli may be carried by patients that have passed through the disease for many months without injury to themselves, but not harmless to others. These individuals spread the disease.

ACTIVE IMMUNIZATION IN SPECIAL DISEASES

Active immunization is produced by the injection of virulent living bacteria, of attenuated bacteria, of dead bacteria, of bacterial extracts and of their toxins, and for passive immunization, the serum of highly immunized animals is used.

The oldest form of this method is variolation against several forms of variola employed during many centuries in India, and introduced by Lady Montague in 1721 in England. Though it effectively and permanently protects it has been abandoned

because it is not without danger and because the vaccinated become a source of infection for others.

Jerner replaced this form of vaccination by using the vaccine of cowpox, attenuated bacteria by passage through this animal. The smallpox virus is passed several times through calves, where it causes the development of typical cowpox, before its employment on man. The immunity produced lasts about ten years, when re-vaccination has to be made for further protection.

Ineffective inoculation with smallpox virus of persons that have been vaccinated, as well as the statistics of all countries where the method is in general use, prove beyond all doubt its absolute protection against the disease.

Anthrax. Pasteur has introduced vaccine of various strengths obtained by growing the bacilli at higher temperature, than suitable for their growth. The treatment is commenced with Vaccine I, cultures grown twenty-four days at a temperature of 42.5 degrees C. and after fourteen days continued with Vaccine No. II, the same cultures grown at the same temperature for twelve days. Immunity develops fifteen days after vaccination and lasts about one year, when it has to be renewed.

Hydrophobia. Immunization is possible in this disease on account of its long time of incubation, from twenty to eighty days; however, an early commencement of the treatment is necessary. The method is protective only when the brain is saturated with antibodies before the virus reaches it.

Rabbits are inoculated with brain substance of a dog that has died of hydrophobia and are usually killed by it in the course of the third week. Repeated passages of the virus through rabbits by injecting them subdurally with it, shorten the time of incubation so that death occurs finally in six days after inoculation; (*Virus fixe*). The spinal column of such an animal is removed and dried in a vessel, the bottom of which is covered with potassium hydroxid. This drying process lessens the virulence of the virus progressively. After drying it at a temperature of 22 degrees C. it kills rabbits in seven days and is harmless when so treated for from twelve to fourteen days.

The treatment in man is commenced with an injection of emulsion made from the spinal column dried eight days and continued with emulsions of greater virulence until finally injections are given, that have been dried for two days only. The emulsion is obtained by triturating a piece of the spinal marrow I. C. M. in length, in 5 C. C. M. of bouillon of which are then from 1 to 3

C. C. M. subcutaneously injected into the abdominal wall. The treatment lasts twenty days, but full immunity is not produced until fifteen days later. The method is without danger, so far, not a single case of hydrophobia has been reported due to vaccination. It is effective. The mortality in the Pasteur Institute of Paris was in 1886, 94% and in 1909-10, 21%, whereas, of those not vaccinated from 10% to 15% died with the symptoms of the disease. The serum of immunized animals and man neutralizes the virus. Pasteur Institutes for the treatment of hydrophobia are now established in all countries and usually in sufficient numbers to make it possible for everybody infected by the bite of a mad dog to be treated in time.

Cholera. In this disease inoculation with dead cultures is preferred, as it has been proven that the antigen are contained with the bacilli and that injections with living bacilli do not give any better results than with dead bacilli. An agar culture twenty Mg. of the Cholera spirilla is thoroughly washed, with 10 C. C. M. physiologic salt solution emulsified and sterilized at a temperature of 58 degrees C., 0.5% carbolic acid is then added to preserve the emulsion. Of this vaccine, 1 C. C. M. two Mg. are subcutaneously injected producing complete immunity twelve days after vaccination, though it commences five days after inoculation, gradually rising to its full height, which is reached on the twelfth day, lasting from one year to fifteen months. The injection gives rise to a local and general reaction. The place of puncture is painful on pressure and shows induration, frequently accompanied by rise of temperature, depression and loss of appetite, with complete recovery in from one to two days.

Vaccination which has been practiced in various epidemics in India and Japan prove that it is effective. The injection causes the formation of large quantities of bacteriolysins and agglutinins that can be shown in the blood after the fifth day. Though quarantine against infected countries and imported cases, measures of disinfection of food and water, early diagnosis, etc., have prevented epidemics in the United States for many years—vaccination is valuable for the protection of physicians and nurses.

Typhoid Fever. Vaccination on a large scale has been practiced by Wright in the English army with forty-eight hours bouillon cultures of typhoid bacilli, heated thirty minutes at a temperature of 53 degrees C. sufficient to kill the bacilli without damaging them: 0.5% of carbolic acid or lysol is added to

preserve the vaccins. Two vaccinations are made at an interval of ten days 0.5 C. C. M. of the vaccine containing 500 million bacilli are used for the first inoculation and a double quantity for the second. The immunity produced lasts three years. Fever, headache, dizziness, depression follow the vaccination, and the place of puncture and neighborhood glands remain painful on pressure several days. The general and local reaction disappears in a few days. Ten days after inoculation large quantities of bacteriolysins and agglutinins are found in the blood. During the negative phase after first and second injections the vaccinated have to be kept in typhoid free surroundings, as during this time they are more susceptible to an infection. According to Wright, vaccination reduces the danger of infection to one-half and the mortality is still more depressed. Vaccination practiced on German troops that were sent to South West Africa, show similar favorable results. Three injections were given of 0.3 to 0.8 and 1 C. C. M. of the vaccine prepared after Pfeiffer-Kolle's method, at intervals of seven to fourteen days. The mortality was reduced to one-half and the character of the disease was favorably influenced, being lighter in the vaccinated.

Plague. Method and results of vaccination differ but little from the preceding. Haffkin, and after him others, have vaccinated many thousands of people with a vaccine prepared after his method in India. A bouillon culture several months old is heated for an hour at a temperature of 65 degrees C., which kills the bacilli and damages little the immunizing substances contained in them; 0.5% phenol is then added as a preservative. Before use, tests are made with the substance by culture, to secure complete sterilization. From 2½ to 3 C. C. M. are injected into the arm or abdomen and repeated in from eight to ten days. Local and general reaction, swelling, pain at the place of injection and fever, vary in different individuals. Sometimes very severe, they may be absent altogether in others and disappear usually in one or two days. Vaccination reduces the mortality over one-half and the disease is less severe in those that contract it after vaccination.

Wright has introduced active immunization with dead bacteria for curative purposes, and the method is now frequently used in local abscess, furunculosis, acne, gonococci infection, cystitis and cholecystitis and so on. The vaccine is best prepared from the pus of the patient (autovaccine). The bacteria are emulsified with physiologic salt solution and heated at a temperature of

60 degrees C. for one hour, which kills them, 0.5% of carbolic acid is added to preserve the emulsion. The dosage for each injection is determined by counting the bacilli.

A negative phase follows each inoculation, which in turn is followed by a positive phase. The opsonic index drops during the former and rises in the latter, to again gradually fall, which is the proper time for a second injection. If the dose has been too large, the drop is decided and the rise little and slow; and if the dose has been too small, negative and positive phase are slight and transitory. Clinical symptoms correspond to rise and fall of the index and may serve as a guide. No injection should be given during the negative phase.

Many more or less successful attempts have been made to extract the immunizing substances contained in the bacilli and to use them for vaccination, instead of the bacilli, in order to increase absorption and lessens toxicity.

Neisser and Shiga have prepared a vaccine against typhoid fever by emulsifying a one-day agar culture of the bacilli in physiologic salt solution, heating it one hour at a temperature of 60 degrees C. keeping the culture two days at 37 degrees, filtering off the bacilli and then adding 0.5% phenol as preservative. A similar vaccine has been prepared for dysentery.

Wassermann in order to eliminate the inflammatory substances contained in these vaccines, reduced the clear filtered liquid, free of bacteria in a vacuum exsiccator to a dry yellow powder, and used a solution of this in normal salt solution, for subcutaneous injection. Bail employed the exudates (bacterial extracts) of infected animals, sterilized, by heating them at a temperature of 44 degrees C. and adding carbolic acid. Injections of this substance produce active immunization and the serum of the vaccinated animals possesses protective power. Wassermann and Citran obtained good results with watery extracts prepared from bacterial cultures.

In 1891, Koch introduced his old tuberculin, a glycerine extract of pure culture of tubercle bacilli. A culture six to eight weeks old, grown in 4% glycerine bouillon, is condensed in a vacuum to 1-10 of its volume and then filtered. Old tuberculin was first recommended by Koch for diagnostic purposes, in cases where a diagnosis could not be made by physical and sputum examinations. Investigations have shown that it is harmless. It does not cause a spreading of the disease to other places. The temperature of the patient has to be normal when the subcutan-

eous injection is made. 0.1 Mg. is the first dosage and the reaction is considered positive when the temperature rises 0.5 degrees C. above the previous injection, accompanied by symptoms of malaise, etc. The dosage is repeated after the reaction has passed. It is frequently more severe after the second injection than after the first. If the first is negative, gradually increasing doses up to 5 Mg. have to be given. The last has to be repeated and if it remains negative, it may be concluded that the patient is free of active tuberculosis. A larger dosage will give a reaction with latent tuberculosis and should, therefore, not be used for clinical purpose. Instead, local reactions produced by vaccination with old tuberculin, are frequently used for diagnosis.

Von Pirquet's cutaneous method consists in thoroughly cleansing the forearms, scarifying two places ten C. M. apart, and rubbing into the scarified places two drops of undiluted old tuberculin with the scarifier. Redness and induration and generally a papule appears within six hours, if the reaction is positive. It is useful with children, is of less value with adults. Moro's percutaneous method is the use of an ointment prepared of lanolin and old tuberculin, equal parts, rubbed into the skin. If positive, redness and small papular effluences follow. The Wolff-Eiseners-Calmett's ophthalmo-reaction is not without danger, and should not be used when the eyes are diseased, no matter what the disease may be. One to two drops of a 1% old tuberculin solution are dropped into the conjunctival sac of one eye, or a tuberculin ointment is rubbed in with a glass rod. From redness to severe inflammation is the consequence in case the reaction is positive; the eye, not treated, remains normal and serves as a control. Ehrlich injects through a fine trocar 1-10 C. M. a very much diluted tuberculin solution into the upper layer of the skin, producing a quaddel, and redness of the canal made by the trocar, if the reaction is positive.

Old tuberculin and a large number of similar extracts are used with advantage for therapeutic purposes. The first reports after Koch's announcement caused a great deal of disappointment, due to the fact that most of the patients treated were not suitable. Since then, the indications are better understood, the treatment with this remedy has been revived and it is now widely used in Sanatoria, and by the general practitioner, especially in places where the tuberculous collect on account of favorable climatic conditions. Advanced stages of the disease, mixed infections and extensive consumptive processes in the lungs, are contra-indica-

tions. The injections produce local hyperemia and an inflammatory exudation of lymph, the leucocytes encapsulate the focus and produce an immunity against the specific toxins. The treatment is commenced with an injection of 1-10 M. G. and continued with gradually increasing doses to 50 M. G. and more. Reactions, fever, malaise, loss of appetite, increased cough, etc., have to pass before a new injection can be made. It has to be repeated after some time, its effect not being permanent. Similar extracts have been prepared from various pathogenic bacteria for therapeutic and diagnostic purposes.

Koch's T. R. Introduced by him in 1897, is prepared from living bacilli, which are dried in a vacuum exsiccator, thoroughly triturated, treated with water and then repeatedly centrifuged, which separates the mass into a clear liquid T. O., and a sediment T. R. which is again dried, triturated and centrifuged. The substance injected causes bacterial immunity and has healing influence on tubercular lesions. New tuberculin is an emulsion of bacilli, well dried and triturated in equal parts of water and glycerin. The treatment commences with an injection of 1-1000 Mg., and is continued with increasing dosage at intervals of from five to eight days, to ten Mg.

Active immunization has but little value for curative purposes. Vaccines protect, but do not cure, according to our present knowledge.

The favorable results reported by Krause and others by the intravenous injection of typhoid vaccine in typhoid fever were soon followed by reports that similar good results would be obtained with the injection of colon vaccine, or solutions of various proteins, such as sterile milk, egg albumin and certain cereal extracts, not alone in typhoid fever, but in various other diseases, as in acute and chronic arthritis, pneumonia, cancer, etc.,—a chill, rise of temperature and leucocytosis and an increase in the proteolytic ferments of the blood follow the injections. The improvement seems to be in proportion to this non-specific reaction. Subcutaneous injections have the effect of intravenous injections, when doses are large enough but the reactions are less sudden and severe.

The improvement and occasionally permanent cure is due to pyrexia leucocytosis, increase of ferments and antibodies. *Not alone are specific antibodies formed, but all defenses of the organism are mobilized by the foreign intruder.*

PASSIVE IMMUNIZATION IN SPECIAL DISEASES

An injection of antitoxin does not produce a reaction. Its effect is almost immediate and lost in a short time, that is, it is rapidly eliminated.

Diphtheria. Horses are exclusively used for the production of diphtheria serum. Each injection of the diphtheria toxin, which is given either very diluted or as a mixture of toxin and antitoxin with a slight excess of toxin, causes a local and general reaction that has to pass before the injection can be repeated. The horses are closely observed during the process of immunization and their weight is frequently taken. The antitoxin can be used only in a concentrated form and the injections have to be repeated until the animals can stand large doses of the toxin. The immunization is usually finished in from two to three months, and after this small injections are made, from time to time, to keep the contents of the antitoxin, as far as possible constant; blood is then drawn from the jugular vein and the serum containing the antitoxin is standardized and used for therapeutic purposes. The unit, after Behring and Ehrlich, is the smallest quantity of antitoxin that neutralizes the hundred times lethal dose for a guinea pig of 250 G. M. A serum that contains this quantity in 1 C. C. M. is a normal serum, it represents one unit in one C. C. The serum has to be tested and if found free of bacteria, especially of tetanus bacilli, the added 0.5% carbolic acid, not too high, and the proteid contents not over 12%, it is ready for distribution. An injection of from 600 to 1000 units is sufficient for immunization, though it has to be repeated in three weeks, if exposure to the disease remains. The dosage has to be far larger if the serum is used for curative purposes—that is, after infection has taken place—and results can only be hoped for if treatment is commenced early enough, before the toxin is firmly anchored with the body cell. This is possible in diphtheria, as the symptoms of this disease appear early. The antitoxin, as soon as injected, neutralizes the toxin and if given in very large quantities may tear it from body cells not firmly united, and so save the patient from death. On the other hand, if treatment is commenced too late, after the poison is firmly anchored with the cells of the organism, it cannot exert this favorable influence. Severe intoxications require larger doses than light intoxications. It is important for practical purposes not to wait until a bacteriological examination is made, and according to the conditions to inject from 3000 to 20,000

units or more. Antitoxin is harmless and serumsickness is rare, as the concentrated diphtheritic serum contains from 500 to 1000 units per 1 C. C. and, therefore, but little alien proteid is injected, even when very large doses of antitoxin have to be administered. The injection has to be made with all antiseptic precautions. It is best in the skin on either side of the abdomen. The serum has to be clear or slightly opalescent—not cloudy. Intra-muscular or intravenous injections may be given if a more rapid absorption is needed. The antitoxin neutralizes the toxin, but has no bactericidal properties. The bacilli may grow in the serum, but are harmless to the individual, as they lose their toxic properties. The immunizing and curative effect of the serum is well established.

Tetanus. The immunization of horses against tetanus toxin is very similar to that used for the immunization with diphtheria toxin. The treatment has to be commenced, however, with a very diluted solution or with a mixture of toxin and antitoxin. Horses are very susceptible to the poison and the reaction after injections are very severe. The doses are gradually increased until the animals can stand injections of 1200 C. C. of toxin. Blood is then taken from the jugular vein and the serum standardized and tested. It has to be free of bacteria. Injections have to be repeated from time to time, to keep the contents of the antitoxin as high as possible.

Tetanus antitoxin injections for protective purposes are largely in use, both with horses and with man, and have proven very effective. Twenty units are sufficient to convey immunity in man and it has become the custom to inject the antitoxin in all cases of suspicious and dirty wounds. By this means the high mortality from tetanus after the fourth of July celebrations from wounds caused by firecrackers, etc., has been greatly reduced. For curative purposes it is far less effective than the diphtheria antitoxin, as the symptoms of the disease appear only after the toxin has been more or less firmly anchored to the ganglion cells of the spinal column. The poison travels along the nerves, and subcutaneous and intravenous injections are less effective than those given directly into the large nerve trunks, though the results obtained even with these are not very encouraging; they depend on an early commencement of the treatment, time of incubation and severity of infection. A long time of incubation and a mild infection give a more favorable prognosis. In every case of tetanus infection, the antitoxin treatment should be tried, as at least the

newly formed toxin is neutralized. Large doses should be injected. The affinity of the toxin to the antitoxin is so great, that if present in large excess it will tear the toxin from ganglion cells if not too firmly bound. Prophylactic treatment is indicated in all cases of dirty wounds, and thanks to this measure, now generally adapted, the mortality due to tetanus has been reduced.

Plague. Passive immunization in this disease was first practiced by Yersin in 1897, in India, on persons living in a plague district. He vaccinated five hundred with 30 degrees C. C. of the serum, each. Of this number, five contracted plague, of which two died. The symptoms of the disease appeared in three on the 12th, 20th and 42nd day after injection. The protection which this form of immunization conveys is of short duration, and the inoculation has to be repeated in from ten to fifteen days, or is better combined with active immunization.

Similar favorable results have been reported by other investigators. Passive immunization does not protect against pneumonic plague. It is important on account of its immediate effect. Shiga and Beredka introduced the combined method of active and passive immunization. To prepare the vaccine, a three day agar culture equal to three lumps, is scraped off, triturated in a mortar, and taken up with physiologic salt-solution, so that each C. C. contains the loop of the triturated bacilli. It is then heated half an hour at a temperature of 60 degrees C. and allowed to stand for twenty-four hours. The first injection is made with vaccine and immune serum, of each 0.6 to 1.0 C. C. and the second injection repeated after a few days, when the reaction has passed, with 0.6 to 1.0 C. C. vaccine alone. This form of procedure has proved more effective. The reaction is light. Unfortunately, the immune serum has but little curative properties, though, according to the reports of all observers, it exerts a favorable influence upon the course of the disease, if treatment is commenced early and the infection is not too severe. It ameliorates symptoms, prolongs life for a few days in most cases and occasionally saves. If the infection is very severe it has no influence. Very large doses have to be injected, 100 C. C. and injections have to be repeated twice and three times every eight hours, followed by smaller injections. Notwithstanding the poor results obtained, it is so far the best and most effective remedy, and should be tried in every case.

The method of preparing the vaccine has been perfected and it is now possible to completely sensitize bacteria by taking the

living cultures and saturating them with specific immune serum, allowing them to stand from twenty-four to thirty-six hours with an occasional agitation, and after testing to ascertain that all the bacteria have united with the amboceptors, the serum is separated only from the bacteria and amboceptors by centrifugation, leaving only the bacteria united with the amboceptor, which is called vaccine sensibilis.

Cholera. The serum of animals immunized with dead cultures of cholera vibrios has bacteriolytic and agglutinating, but no antitoxic properties and it is but little effective, as the severe symptoms of this disease are due to intoxication. The vibrios multiply rapidly and unless the serum is injected immediately after infection, it may do harm by its bacteriolytic power, setting large quantities of endotoxins free, increasing the intoxication. An effective antitoxic serum has not been produced so far, notwithstanding the many efforts that have been made in this direction.

Typhoid Fever. Kolle recommends a highly concentrated bactericidal serum in small and repeated doses, and believes that it will dissolve bacilli that circulate in the blood and will prevent their propagation in the organs.

Chantemesse has introduced an antitoxic serum by injecting horses with a mixture of typhoid bacilli and a toxin derived from a culture of the bacilli in bouillon, made from the spleen of cattle, in contact with oxygen. One injection is usually sufficient, rarely are two necessary. It increases phagocytosis. The reaction varies from a few hours to several days, during which the fever may rise, followed by general and rapid improvement. The mortality has been reduced from 17% to 4% in the hospitals of Paris by this treatment. Notwithstanding these favorable reports, it has not found general favor, neither have the antitoxic sera, produced by Boredska, Kraus, Aronson and others come into general use.

Pneumonia. The immune serum most frequently used and prepared after Roemer's method is polyvalent. Horses, cattle and sheep are immunized with virulent cultures of pneumococci from various patients. This is done to obtain a serum with different amboceptors, to give the various complements circulating in the blood, a chance to unite. The serum is very effective in corneal ulcer, the cause of which, is usually the pneumococcus of Fraenkel and Weichselbaum and its prophylactic power is of still greater importance. It should be used in every case of injury to the

cornea. When used for curative purposes in pneumonia, from 200 to 400 C. C. M. should be injected. It increases leucocytosis and is harmless. Results are very difficult to judge in this disease, the course of which depends on so many varying conditions.

Meningitis. The serum is prepared by immunization of horses with a fresh culture. A number of different meningococci taken from the spinal fluid of man are used. A number of these sera are sold, prepared according to this plan, more or less modified. If the treatment is commenced early, and the injections are given directly into the spinal canal, the results are not unfavorable. It is useless in the subacute and chronic state. Flexner's statistics show a mortality of 31.4% in 712 treated, and of these 25.3% of those that were injected during the first three days, 27.8% injected between the 4th and 7th days and 42% in those in whom the treatment was commenced after the 7th day. The minimum dose for children two years old is 5 C. C.—for older children ten, and for adults from twenty to forty C. C. A slightly larger quantity of spinal fluid has to be withdrawn before the injection is made and these have to be made with great caution, on account of possible anaphylaxis.

Tuberculosis. Antitoxic sera have been prepared by Marmoreck, Maragliano and Ruppel, by treating horses with injections of dead cultures of virulent tubercle bacilli and their extracts and toxins. The treatment with these sera is not very satisfactory. It seems to give some results in pure incipient tuberculosis, but is useless in mixed infections and in the more advanced stages of the disease.

Dysentery. The treatment of dysentery due to an infection with the Shiga-Kruse bacillus with antitoxic sera has given results. Horses are immunized with dead cultures of virulent bacilli and toxin, producing a serum that possesses antitoxic and bactericidal properties. A number of these sera have been prepared by various investigators and tried on a large scale in the epidemics of Japan. Rosenthal reports a mortality of 4.5% in 157 patients treated with serum and Vaillard and Dopfer a mortality of 2% in 500 patients treated with antitoxic and bactericidal serum prepared by them.

In sepsis, puerperal fever, pyemia, erysipelas, articular rheumatism, and other diseases, which are due to streptococcus infection, serum treatment has been tried with more or less success. The subject is still under investigation. The sera are pre-

pared by injecting horses with cultures obtained from different severe infections of man, or by injecting streptococci made highly virulent by passing them through rabbits or with a mixture of both varieties. It has not been decided so far, which of these sera is the most effective. In acute affections, the treatment must be commenced early and with large doses. In chronic affections the doses have to be small and intermittent, gradually increasing in size and extended over a longer period of time. The treatment is contra-indicated in endocarditis, pericarditis and pleuritis.

Hay Fever. Hay fever has been treated on a large scale with antitoxic serum prepared by injecting horses with pollentoxin. The reports differ as to the efficacy of the treatment. Some have obtained very favorable results, others have failed altogether. It seems to act best in the milder forms of the disease, and has some prophylactic properties. It was formerly used locally by allowing a drop or two to flow into the conjunctivæ sac and nose, or as a powder in the same locations. Some people become intolerant to the treatment after the applications have been repeated for some length of time.

Since 1914 some English and American observers have reported favorable results with injections of small doses of Pollen extract; Timothy Pollen extract for the treatment of the spring variety; Ragweed Pollen extract for the treatment of the autumn type of the fever and the two extracts combined for the treatment of cases that commence early and last long.

The substances that protect and cure in vaccine and serum therapy are contained in the blood, prepared by the cells of the infected organism. They may be artificially produced and subcutaneously, intramuscularly, or intravenously injected into man. The blood containing them in sufficient quantity will kill the bacteria and neutralize their toxins coming in contact with them. Other therapeutic methods have to be combined with this—a method of substitution—to increase the power of the patient to produce the defensive substances and to bring the curative agents where they are needed.

CHAPTER XI

ORGANOTHERAPY

The inter-relation of organic functioning was known to the ancient physicians. Its mechanism, however, was only studied during the last few centuries, and not until the Nineteenth Century, after Proschaska's discovery of the reflex arc, was it generally accepted that the nervous system regulates and presides over organic functions.

Reflex acts, inherited and acquired, suited to the demands of the organism at all times, in harmony with the function of all, increase or decrease the activity of any particular organ when needed.

The importance of the activity of the various organs was recognized in the most remote ages, and healthy organs were administered to cure disease. It was common practice to give the lung of a fox in diseases of the lungs, and wolf's liver in liver disease. Pliny recommended the use of testicles of the donkey and of the stag as aphrodisiacs, and long before him, organotherapy was used in a similar fashion.

Claude Bernard was the first to recognize that every organ of the body produces a secretion and passes it into the blood. Brown Sequard, the founder of modern organo-therapy, stated in 1869, that all glands, including the ductless, produce internal secretions that pass into the blood, and that an excess or a deficiency of these secretions causes disease. Twenty years later he made his celebrated experiments on himself, by injecting testicular juice (*liquide testiculaire*), observing great increase of physical strength and mental activity after the injections. He proved thereby his theory given to the world twenty years before, that the internal secretions of an organ affect many others, in fact the whole organism.

Every organ, every tissue and every cell is enervated, secretes and, by way of the blood, influences every other cell of the organism, though in some instances, the secretion may act directly as a stimulant. The gastric juice that causes the opening of the sphincter of the pyloric orifice at regular intervals and the secretions of the intestinal mucosa that produces peristaltic move-

ments of the intestines, are the direct causes of these simple reflex acts. The chyme passing from the stomach into the duodenum, causes the production of secretine in the epithelial cells of the mucous membrane of the intestines, which, by way of the blood, causes a secretion of pancreatic juice, stimulates the liver cells to produce bile and the intestinal glands to secrete intestinal juice.

Such substances act upon distant parts of the body and have been called hormones, chemical messengers, a term now generally used, derived from the Greek, meaning "excitant or stimulant". The substances produced by every organ, every tissue and every cell as internal secretions are different from the substances that serve to defend and protect the organism in disease, which causes their formation, though a division line between the two cannot sharply be drawn. It is merely a matter of agreement to classify those that protect the organism from auto-intoxication due to intestinal fermentation, caused by the ingestion of food, with the internal secretions. It is, however, generally conceded that an organ of internal secretion has two functions to perform, the production of hormones and the conversion of toxic substances that circulate in the blood into non-toxic substances, whereas organs like the kidneys, lungs, intestines and skin principally eliminate. The liver, spleen, bone marrow and the lymphatic system fix the degenerated red and white cells of the blood, convert them into bile pigment and other useful substances needed in the economy of the body. Chemical processes of oxydation, disoxydation, hydration and dehydration, of analysis and synthesis, convert toxic into non-toxic substances and a simple addition or union of a poison with a product of the body may serve the same purpose to make it inert.

Ammoniac formed by the organism in considerable quantity and Ammonia Salts ingested, are converted by the liver into the non-toxic urea. If a communication is established in dogs between the vena porta and vena cava "Eck's fistula", and the blood containing ammoniac, instead of passing through the liver enters the general circulation, in a few days, there follow serious symptoms of intoxication, especially after a meat diet, states of depression and excitation, tonic and clonic convulsions and coma. This proves that the liver is an organ that protects the body from ammoniac intoxication. Deficient or excessive functioning of an organ is followed by symptom of intoxication. Poisons produced by the organism, or ingested, are not destroyed, and the potential energy bound up for special and steady work, reacting in

normal conditions to certain stimuli, is set free, and causes symptoms of poisoning, pains, convulsions and coma.

Hormones act upon distant parts of the body, stimulating or inhibiting, and if they are due to the failure of an organ to act, not present in sufficient quantity, or set free in excessive quantity, symptoms of a severe intoxication mark either event.

Loeb has recently shown that certain metallic ions, those of sodium, potassium and especially of calcium, exert a similar influence. He claims that calcium ions circulating in the blood prevent constant rythmical contractions of the skeletal muscles.

Internal secretions may be divided into those that furnish energy and nutritive material to organs and tissues of the body, as the albuminous substances circulating in the blood and the sugar derived from the glycogene of the liver, always present in large quantities exciting or inhibiting the activity of distant parts of the body for this purpose; and into hormones proper, acting in small quantities. The latter may be again divided into those that cause assimilation, anabolic, and those that cause disassimilation, catabolic, in character. The former stimulate growth and the latter inhibit it. Anabolic and catabolic processes are carried on simultaneously to preserve the metabolic equilibrium. Hypertrophy is the consequence, if anabolic processes predominate. Inhibiting hormones cause assimilation, and exciting hormones cause dissimilation. They are either simply by-products or end-products of catabolism, or complicated substances produced by synthesis in various organs. To the former class belongs the carbon dioxide circulating in the blood, which acts as hormone upon the respiratory center. Increase of carbonic acid causes increase of frequency and depth of the respiration to supply the demand of oxygen to the tissues. Normal breathing is almost entirely regulated by this means, though it is influenced and modified by peripheral stimulation. Adrenaline, thyroidine and many others belong to the latter class. It is a characteristic feature of all hormones that they act in very small quantities and in co-relation to the nervous system, probably only as excitants or depressors of nervous influences to regulate the organic functions.

Clinical observations and post-mortem findings have been an early and most important means to study the functions of the internal secretions and the sequels of castration were long known and were made use of to fatten animals. Addison described in 1855 the clinical picture of the disease that bears his name, due to a destruction of the suprarenals, and Basedow and Graves added

their share, publishing observations of exophthalmic goiter, and the studies of myxedema and acromegaly, disclosed diseases of the thyroid and pituitary body.

Addison's disease and myxedema due to destructive processes of glandular tissue, give rise to decreased functioning and Basedow's disease and acromegaly due to hyperplasia, cause increased functioning. Operations performed on various organs, especially on the thyroid and pituitary body for extirpation of tumors, have materially increased our knowledge on the subject of internal secretions, and experiments on animals, extirpation and destruction of various organs, has settled their importance in the life process of the organism and has led to a better knowledge of their physiology. Pancreatic functioning has been proven by extirpation and partial destruction of the organ in animals and the same method has led to the knowledge of the parathyroid bodies, though the results obtained have to be considered in the light of the violence and severity of the operation, injury of nerves and its influence upon the circulation that cloud the results.

Compensatory hypertrophy of the remaining tissue or organ, occurs after a partial or an entire destruction of an organ, if it is present in pairs, though other organs may act vicariously and hypertrophy. Hypertrophy of the pituitary body has been observed after thyroidectomy. Transplantation of ovaries, testicles, thyroid, suprarenals, etc., does not cause disease, whereas extirpation of either organ leads at once to harmful results. This proves that the secretion of the organ is necessary to protect the body, and that disease is not caused by the method itself, as has often been maintained. The excellent results obtained by the administration of organic extract in destructive diseases of the thyroid, proved that the active substances are present in the juice of the organs, which may be expressed, and that they act in minimal quantities, though the test with the products of other glands has led to some disappointments.

Oliver and Schaefer discovered in 1894 the effect of various extracts to raise or lower blood pressure and adrenaline and pituitary extracts are now largely used to affect the circulation.

The thyroid, a ductless gland, is at present the most important organ, from a therapeutic point of view. Its diseases are well known and organotherapy in some of them, at least, has given good results. The gland consists of two lobes, situated on both sides of the trachea, connected through a third lobe the Isthmus. It is highly vascular. Three to five arteries, connected with a

large net work of veins, supply it with blood, and a large number of lymphatics empty into the deeply situated cervical glands. The size of the thyroid varies in different individuals. Not rarely, accessory lobes are found, detached from the main body, usually near it, though they have been discovered in the pleura, mediastinum and in other places. The gland is surrounded by a capsule of dense areolar tissue and its vascular parenchyma consists of a delicate network of fibrous tissue, in the meshes of which are embedded vesicles, surrounded by capillaries and lined by a layer of cylindrical epithelium. The vesicles are filled with a colloid substance, generally considered to be the product of a secretion of the epithelial cells, which in various ways, not fully ascertained at the present, enters the blood. Iodine, though found in minute quantities in every organ of the body, is the characteristic substance of the thyroid, which contains eight to ten times more iodine than any other organ. Arsenic is also a constant ingredient of the gland. The thyroid of the new-born is free from both. Iodine is derived from the food and deposited in the gland as iodethyrine or thyroidine. It is not present, or found only in very small quantities in Basedow and in cystic and fibrous degeneration of goiter, whereas, goiters rich in colloid substance contain a very high percentage of iodine.

The parathyroids are small kidney-shaped, brownish-red or yellow bodies, 3-1⁵ m. m. long and 2-4 m. m. thick, usually two attached to each of the lateral lobes, the one superior-posteriorly and the other inferior-anteriorly. Occasionally accessory bodies are found. The liberal blood supply is derived from the inferior thyroid artery. The parathyroid consists of a mass of cells surrounded by a fibrous capsule from which occasionally layers divide it into little lobes. The cells are imbedded in a fine capillary net work and contain fat droplets, glycogen and not rarely colloid substance in follicles similar to those of the thyroid.

On account of the great vascularity of the thyroid, communicating directly with the cerebral circulation, it was long held that the function of the organ was to regulate the blood supply to the brain, serving as a reservoir for the large quantities of blood, coming or going. Swelling of the gland during menstruation and pregnancy suggested a close relationship between the thyroid and the female genital organs, and on account of structural similarity, with the spleen and lymphatic glands, it was held to assist the blood-making organs. Its vital importance for the whole organism was finally recognized from the serious consequences that fol-

low its removal. Two entirely different and distinct clinical pictures were observed after the operation in men and animals. The one consisted of serious disturbances of the nervous system, tremors, convulsions and psychic changes "Tetany" the other, marked by interference with growth, and general nutrition; a peculiar swelling of the skin and a progressive loss of intelligence—"Myxedema", or "cachaxia strumipriva". With the discovery of the parathyroid bodies, an explanation was found for this double complex of symptoms. It was shown experimentally that a removal of the parathyroids causes tetany and that extirpation of the thyroid, leaving the parathyroids as much as possible intact, is followed by myxedema. This view is now generally accepted. A large number of experiments has been made on animals which have shown that, regardless of the species, a parathyroidectomy causes tetany, which in more or less time, is followed by death. The symptoms vary somewhat according to age and type of the animal and its dietary. Symptoms of the acute and latent form as well as chronic tetany have been observed to follow the operation. Latent tetany may follow a partial parathyroidectomy—that is, if not more than two of the parathyroid bodies have been destroyed or extirpated. Pregnancy leads usually to acute attacks in these animals and injections of various poisons, morphine, calomel, atropine and others has caused the condition. Partial parathyroidectomy means partial insufficiency and loss of protective power. The nervous symptoms that invariably follow the complete or partial operation, are accompanied by trophic disturbances, falling of hair, eczemas and extreme emaciation, the more marked the longer the animal survives.

These experiments on animals explain readily the tetany that has so often followed thyroidectomies, due to destruction or removal of the parathyroid bodies, and it must be the first consideration of the surgeon to leave them intact and only to remove a part of the thyroid when operating. Injury to the parathyroids may cause passing tetany, as in does in animals, and acute attacks of tetany during pregnancy and lactation are due to disease and partial destruction of the parathyroids. Tetany of children is thought by many observers to be caused by the same conditions and hemorrhages and blood pigment have been found in the parathyroids of children that have suffered during life from this disease. The analogy with the animal experiments leaves hardly a doubt that the other forms of tetany, especially the gastro-intestinal forms of intoxication, are produced in the same

manner. Not these alone, but a number of other diseases of the nervous system are thought to be caused by disease of the parathyroids—such as Thomsen's disease, Myotonia congenita and Parkinson's disease, Paralysis agitans due to hypofunction, myotonia and myasthenia gravis pseudoparalytica due to hyperfunction of the thyroid. All belong to the neuroses, characterized by muscular spasms, clonic and tonic convulsions and tremors without known pathological lesions of the nervous system. Transplantation of the parathyroid bodies, and in the earlier attempts, implanting these glands into the peritoneum, abdominal rectus, spleen, to cure and to prevent tetany following parathyroidectomy, has been tried with some success. These operations have demonstrated that parathyroid bodies of the same species grow in the new situations and delay the appearance of the disease, though after a few months they commence to degenerate and gradually disappear altogether.

Eiselsberg has performed grafting in a woman who had the thyroid removed twenty-seven years previously, with favorable results; that is, with the exception of a few remaining glottis spasms, she was cured.

The results obtained with feeding parathyroid substance and administering of the watery extract by mouth or subcutaneously vary; as a rule, they are not favorable. On the other hand, thyroid extract, which has been very largely tried, has given good results in this disease following operations and should be tried in every case of postoperative tetany, though its action is not yet fully understood. The medication is one of substitution, the active principle produced by an organ that has failed to function, to constitute a part of the blood, is artificially prepared and supplied. The reports of this therapy in the treatment of the neuroses mentioned are meagre. I have tried thyroid extract without success in a case of paralysis agitans and in a case of myasthenia gravis pseudoparalytica.

The exact relation of the parathyroids to the thyroid has not been established, though it has been shown that the former hypertrophies after thyroidectomy and the latter after parathyroidectomy. These observations as well as the excellent results obtained with thyroid medication in post-operative tetany, prove beyond question that such relation exists between these organs. The hypertrophy is compensatory. Neither have numerous investigations and experiments given any satisfactory results as to origin and character of the toxic substance circulating in the blood that

produces tetany. The fact that free blood letting will stop an acute attack, for a short time at least, speaks decidedly in favor of the presence of a poison. It affects the central nervous system, whatever it may be, the higher centers and peripheral nerves, causing increased excitability and clonic and tonic convulsions. Numerous thyroidectomies performed on different types of animals have shown the great and vital importance the gland possesses. The results obtained, vary somewhat with the species, but are nevertheless in the main uniform. In the young, serious disturbances of growth, retarded growth, especially of the bones, is the typical consequence of the operation. With it, hypertrophy of the pituitary body, of the suprarenals and hypoplasia of testicles and ovaries have been observed. In the adult and full-grown animals, loss of appetite and progressive emaciation are the most characteristic features and trophic disturbances, such as falling of hair, dryness of the skin, and eczemas, and in some animals—in monkeys, sheep and others—loss of intelligence, has been noticed. Hypertrophy of the pituitary body, sometimes double and treble its normal size, has invariably been found on autopsy. Metabolism is depressed.

The serious conditions due to deficient functioning of the thyroid caused by degeneration and atrophy of this gland, were first described by Gull in 1873, and by Ord in 1877, who classed it as an independent disease, called by him "Myxedema". However, not until the publications of Reverdin and Kocher, in 1882 and 1883, on the disease following thyroidectomies in goiters, was the importance of the internal secretions of the thyroid in the economy of the organism fully understood. It was found that in the young, in animals and men alike, growth of the bones, as well as of the soft parts of the body was interfered with, and that this marked inhibition of growth, especially affects the long bones, whereas, the growth in width remains practically undisturbed. Development of ovaries and testicles is retarded and maturity delayed, the pituitary body hypertrophies and degenerates and intelligence diminishes. Children resemble cretins in appearance and action. In adults, changes in the skin appear after the operation, which have given the name to the disease. It turns white and waxy, becomes elastic, dry, cold and edematous, an impression with the finger, cannot be made. The face becomes pale, full and puffy and similar changes appear in the arms and legs. Hair turns white, falls out, perspiration stops and the infiltration of the skin and mucous membranes become marked. The body of the patient appears swollen, and

he becomes lazy, awkward and dull. Intelligence diminishes and strength of muscles decreases. Menorrhagia is a constant symptom of the disease in women and sterility in men show the relation between the thyroid and the sexual organs. Albuminuria and glycosuria occur occasionally and the body temperature sinks below normal. The disease does not appear if a part of the thyroid has been left in place, unless this portion degenerates. The symptoms of genuine myxedema do not differ from those following the excision of the organ, proving that the disease is caused by the absence or degeneration of the gland, which is always found on autopsy in this disease. Atrophy of the organ, degeneration of the parenchyma and increase of interstitial tissue, are its prominent pathologic features. The disease is slow and progressive. Its remote cause is unknown. Women are more subject to it than men and the sexual organs are frequently involved. This symptom complex is not found in all cases. Like all other diseases, it has light and severe forms, and in the former, "formes frustes" only a few vasomotor and trophic disturbances may be noticed, which yield readily to thyroid medication. These incomplete cases, of which much has been said and written, represent probably a phase in the course of the disease.

Sporadic cretinism may be considered an infantile myxedema. The patients show the characteristic inhibition of growth. They are generally dwarfs and idiots, the skin is myxedematous, the hair does not grow, tongue and lips are thick, the nose is flattened and the face appears dull and large. They are without power of speech and walk awkwardly, or are not able to walk at all. Dentition is delayed and puberty does not appear. This form of the disease has been divided in the congenital and infantile myxedema proper. The cause of both conditions is the absence or degeneration of the thyroid gland. The infantile form appears in the fifth, or after the fifth year, and is identical with the disease in adults. The congenital form commences with the birth of the child, due to an entire absence of the gland, characterized by its severe form of dwarf growth, idiocy and other symptoms of myxedema. Though very closely resembling endemic cretinism, it can be differentiated from it by its sporadic occurrence, not confined to certain localities and never being associated with goiter, which is the rule in the endemic form. This is, in fact, its most prominent feature. Endemic goiter (strumous goitre) and cretinisms are always associated, and it is thought that strumous goitre is a degeneration of the thyroid, of which cretinism is the

last stage. Both diseases occur, only in certain territories, usually high mountainous regions. Investigations have established the fact that a toxic substance contained in the water derived from certain marine geological formations of the palaeozoic age is the cause of the degeneration of the thyroid. Certain springs seem to be especially rich in it and cause the disease in persons who drink the water. Boiling destroys the poison and it has been thought, therefore, that the toxic agent is an organic specific substance. Micro-organisms have not been found so far. Wilms and Bircher, who succeeded in producing goiters in monkeys, dogs and rats by feeding them with water from goiter districts found that the filtered water causes it, whereas the residue does not. They have come to the conclusion that a toxine is the cause of the disease. Cretinism has also been produced in dogs by the same observers. Clinically endemic and sporadic cretinism are identical and dwarf growth, idiocy, and undeveloped sexual apparatus and trophic changes, like those found in myxedema, are characteristic of both. The degeneration of the thyroid is their direct cause and thyroid medication cures them.

Various forms of infantilism must be classified with diseases due to thyroid degeneration. The organism remains infantile in character, the skeleton, the organs, the sexual apparatus, the psyche, and is caused by hereditary lues or alcoholism, diseases of the brain or severe infectious diseases, tuberculosis acquired in early infancy, or by poor hygienic surroundings, etc. Since the importance of the internal secretory organs in the somatic and psychic development of the individual has been recognized, all forms not due to such a cause are considered due to disease or anomaly of the internal secretory organs. Brissaud calls these forms myxedematous and is of the opinion that all forms of infantilism are thyrogene in character. True dwarf growth has to be differentiated from infantilism. The individuals are born small and remain small, or they are of normal size and cease to grow at a certain time. Mycromelia, foetal rachitis, characterized by short extremities, large head and trunk and absence of defects of intelligence, belongs to this class, and mongolism, with its dwarf growth, undeveloped sexual organs, obliquely set eyes and disturbance of intelligence, is related to these diseases, though the thyroid is often found normal, and the cause of the disease is at the present thought to be due to an anomaly of testicles or ovaries.

In a number of cases of Dercum's disease, *adipositas dolorosa*, disease of the thyroid has been observed, verified in some cases

by autopsy, though in others, the pituitary gland has been found diseased. The most prominent symptoms are obesity and circumscribed painful fatty tumors, muscular weakness and apathy. Favorable results are reported from thyroid medication. This method of treatment has, however, completely failed in the hands of some. The few cases I had under observation have all been benefited by the treatment. Finally senile degeneration resembles myxedema. Falling of hair and teeth, pronounced changes of the skin, deposition of fat followed by progressive emaciation, loss of sexual power, atrophy and degeneration of the internal secretory organs, and gradual loss of intelligence—in fact, of all organs—and especially of the gastro intestinal tract, are all present in myxedema.

It is a question, whether the degeneration found in the thyroid is not the cause, but rather an accompanying affection, of age. It seems that the changes produced in arteries and kidneys by the wear and tear of life, causing a supply of blood insufficient and impure, lead to senile changes, of which they themselves form the most important part, and in which the thyroid shares. Schiff was the first in 1884, to graft the thyroid for therapeutic purposes and he has had many followers. The results have been disappointing on the whole. Even if the graft is well established it commences to degenerate after awhile and the disease reappears. Eiselsbergs' successful grafting has been mentioned and another case has been reported by Macpherson, who performed this operation successfully in a patient suffering from myxedema. Bircher reports a case in whom the symptoms reappeared three months after the first grafting and nine months after the second. The method has been abandoned since the introduction of the thyroid medication by mouth, though occasionally it may be useful when this fails. The therapy is one of substitution. Substances produced by the normal thyroid are introduced into the blood when the function of the gland is insufficient to supply the demand, that is, normal constituents of the blood are added when missing. Murray was the first to use glycerine extract of the thyroid by subcutaneous injection and soon afterwards Horwitz also experimented. McKenzie and Fox introduced feeding of the gland by mouth, with excellent results. Kocher showed the striking effect of this medication in cachexia strumipriva, lasting many years, the symptoms returning on discontinuing the thyroid preparations, and in myxedema of infants, in adults and in cretinism the results have been similarly successful, though it may take

several months before most or all of them have been removed, and in the very severe progressed cases, only a partial success can be hoped for. Dercum's disease is favorably influenced in many instances and so is obesity, when not caused by an injudicious diet. There are quite a number of other affections, in which thyroid extract has been used with success; simple goiter, scleroderma, chronic psoriasis, arteriosclerosis, rheumatoid arthritis and many more. It must be understood, that these conditions, though not due to diseases of the thyroid, may be benefitted by such a treatment, when the inter-relation of the glandular functions are taken into consideration. A new supply of its acting principles to the blood will cause improvement in a large number of cases. I first employed the extract in treating a case of rheumatoid arthritis, twelve years ago, without success. Since then I have seen many favorable reports and have used the treatment again with good and permanent results. A weak heart is considered a contra-indication to this method, though it may be safely employed cautiously and in small doses. I have often used it without trouble in the obese with fatty hearts of marked weakness. In glycosuria and albuminuria it must be used with caution.

Caution is necessary with the employment of any drug, or any method of treatment and in any case. It is always well to begin with small doses and gradually to increase them to effect, then to continue for six or eight weeks and discontinue for fourteen days, etc. This is a good plan to use in any medication that has to be continuous, varied as to length of time, of administration and of interruption of the medication to meet conditions. Each case has to be studied and the dose adopted to the needs, combined with other methods of treatment, to get the best results. The preparations may have to be changed, sometimes one will not act when another will give good results. According to most observers the fresh gland is the most active preparation, then the gland substance dried at 60 degrees C. and lastly the various extracts of which thyroïdin is the most active and most widely used. Fraeïkel's antitoxine counteracts the nervous symptoms. Excessive use causes symptoms of thyroidism; tachycardia, dilatation of the arteries and fall of pulse tension, sometimes desirable and sometimes dangerous, when it is a defensive measure of nature; tremor, insomnia, delirium, fever, nausea, vomiting, diarrhea, wasting, polyuria and polydipsia, paresthesias, numbness of fingers and toes, itching and heat, and in extreme cases tetany has been observed. Goiter has never been produced by

thyroid medication. Hypofunction of the thyroid depresses metabolism, the patients gain in weight and the reverse takes place in hyperfunction of the gland or when thyroid medication is employed.

Basedow's disease—exophthalmic goiter—described by him in 1840, marked by tachycardia, exophthalmos and tremor, is a disease of hyperfunction of the thyroid. A number of other symptoms have been added and incomplete forms—"formes frustes"—have been described, in which not all of the symptoms are observed and though goiter is one of the cardinal symptoms of the disease, Basedow sine goiter is known. A large number of the symptoms are in direct contrast to those of myxedema.

Goiter is accompanied by rapid, often tense pulse, palpitation, wide opening between the lids and exophthalmos, thin, tender and moist skin, nervous excitation, restlessness and tremors of the extremities, increased reflexes, rapid respiration, perspiration, wasting and occasionally psychoses.

That the origin of exophthalmic goiter is due to hyperfunction, of the thyroid, is the accepted view, though opinions are divided, whether primary or secondary, and a number of clinicians still hold that it is due to excessive innervation of the organ by the sympathetic. The enlargement of the gland is due to an excessive vascularity and hypertrophy of the parenchyma, occasionally, and not very rarely, an enlarged thymus is found associated with exophthalmic goiter, contra-indicating an operation. The left ventricle of the heart is hypertrophied, rarely dilated, exophthalmos is hardly ever absent and with it tachycardia is a constant symptom, both due to sympathetic excitation, which also explains the vasomotor disturbances, excessive perspiration, increased temperature, etc. Metabolism is increased.

The symptomatology, offering such a decided contrast to the symptoms presented by myxedema, leave no doubt as to the correctness of the view that the thyroid is the cause of both diseases. In exophthalmic goiter, the system is flooded with thyroid substances, circulating in the blood, whereas, an almost entire absence of these is the cause of myxedema. Successful partial thyroidectomy in Basedow is conclusive proof.

Administration of thyroid preparations increases the severity of the disease, as would be expected; it adds substances that may produce thyroidism in the normal. Ballet, Enriquez and later Moebius have introduced the serum of thyroidectomized goats, reasoning that the toxins circulating in their blood could be util-

ized to neutralize the surplus of the excessive thyroid secretion in exophthalmic goiter. After it was found that the specific toxins were passing into the milk, this was used for the same purpose, and this milk as powder—"Rodagen"—has been largely employed and though favorable results have been reported, the treatment has often proved disappointing.

Many operators report very good results from partial thyroidectomies and Roentgen rays have been used quite extensively with the object to destroy parenchymatous tissue of the thyroid.

I have treated a large number of these patients, obtaining good results with a combination of various methods of which physiologic methods, diet, and suggestion are of great importance. To this arsenic in some form, sodium cacodylate by injections, the bromides and valerian occasionally are added. If the disease is severe, the patient should be put to bed until the more acute symptoms have subsided. The following case is interesting:

The patient whom I saw in consultation, was in bed, a typical picture of an advanced Basedow, Orthopnoea, cyanosis, rapid, feeble pulse, tremors, protruding eyeballs, goiter and dilated heart with loud systolic blow, extremely emaciated. He had lost about forty pounds in a year and was covered with a cold perspiration. This patient, financially well situated, refused an operation, drifted from physician to physician, from city to city, was treated with serum, and landed finally with the Christian Scientist. He is now in perfect health. It is curious, I may add, that he is a Hebrew. My own cases, as well as the cure of this patient by suggestion alone, speak very much in favor of a nervous influence upon the thyroid, causing the trouble. Simple goiter is a degeneration of the thyroid, consisting in hypertrophy and hyperplasia of the organ. The symptoms produced are mostly due to pressure upon the trachea, nerves and vessels of the neck and give rise to the disturbances of the respiration and circulation, in consequence of which, the heart is frequently found enlarged, especially the right heart. Hyperfunction of the gland is rarely observed, though all goiters are not the same. The degeneration may lead in some to deficiency and even entire absence of function and in other to hyperfunction. Tachycardia, palpitation, tremors and vasomotor disturbances and symptoms of hyperthyroidism are observed. Endemic goiter and Cretinism are due to the same cause, probably a toxic substance contained in the water of goiter districts. Thyroid medication is often successful. Thymus extract has also been employed with favorable results.

THE THYMUS

The thymus is originally an epithelial structure, which according to some observers is directly converted into lymphoid tissue, whereas others believe that mesodermal elements invade the epithelial organ. Still others believe that the medulla is derived from the endoderm and the cortex from the mesoderm. Some believe that the thymus is a blood-making organ basing their views on the mass of lymphocytes that pass from it; other observers hold that the organ attracts lymphocytes as nuclein carriers.

The thymus is in the first embryonal state a purely epithelial structure, vessels and interstitial tissue grow into it, and gradually a differentiation of medulla and cortex takes place. The organ continues to grow up to the second year, and during this period it is solid and full of secretion. Involution commences at the end of the second year and progresses up to the time of puberty. A small rest of parenchyma persists imbedded in Waldeyer's retrosternal thymic fat body, which preserves the form of the organ throughout life, and which, seen with the naked eye, can be recognized as something definite, something more than a mere fat cushion to support the large vessels.

Waldeyer published the results of his investigations in 1890. Hammar insists that it is incorrect to speak of a persistent thymus. Parenchymatous tissue remains until old age and the persistent thymus is normal, in comparison with other organs that atrophy with age. Notwithstanding the views of these prominent anatomists, it is still generally believed that the gland ceases to exist at the fifteenth or sixteenth year of life, and that fat and interstitial tissue with a few particles of parenchyma are all that remain at that time, gradually to disappear altogether. It is well settled that a close relation exists between the thymus, the thyroid, and the sexual organs. Castration causes continued growth and hypertrophy of the thymus, and great sexual activity hastens the involution of the gland in animals. Involution of the thymus has an inhibiting effect upon these organs. The relation that exists between thyroid and thymus is shown in the case of the hyperplastic thymus when for various reasons the thyroid has atrophied or has become functionally insufficient.

To study the function of the Thymus, Boletti in 1845 was the first to perform thymodectomy in animals. His experiments were followed by many observers, the results obtained up to date, differ,

though it may be accepted as an established fact that this operation does not cause death, that the thymus is not absolutely necessary to sustain life. It was further found that a close relation exists between ovaries, testicles and this gland. The evolution of the thymus has an inhibiting effect upon these organs and its involution materially influences their growth and development. Atrophy of the thymus has been found associated with fatal marasmus in children. The relation that exists between thyroid and thymus is also shown by the so-called *persistent thymus* when for various reasons the thyroid has atrophied, or become functionally insufficient.

Thymic hyperplasia is frequently found associated with goiter. Mott analyzed ten cases of exophthalmic goiter, in which the patient died shortly after operation on the thyroid, and found thymic hyperplasia in every one of these cases. He compiled 133 similar cases from the literature and found that in 76.5 per cent. of the those that had died after operation the thymus was enlarged. Tetany following thymectomy is not as severe as that following ablation of the thyroid and parathyroids, and according to the observations of Bash not more than one-tenth of the dogs operated upon die in tetany. Thymectomy slows body growth and interferes with bony growth; the bones remain soft and fracture easy. According to Friedleben the thymus possesses a great vitality and can regenerate itself from a small residue.

Svehlo observed in 1896 that the intravenous injection of thymus extract in man and animals lowers blood pressure and increases pulse frequency he showed further that the active principle formed after birth increases in strength with advancing years and remains active up to the fortieth year of life. His observations were confirmed by a number of investigators who found, however, that substances lowering blood pressure could be extracted from other organs and tissues and that, therefore, this action of thymus extract is not a specific one. It was further observed that the extract increases the coagulability of the blood and may cause thrombosis.

Paltauf described in 1889 a condition characterized by hypertrophy of the whole lymphatic apparatus, the glands of the neck, the axilla, the mesentery of the intestines, the tonsils, the spleen, and the thymus. Bartels added to this syndrome the presence of a small heart, narrowness of the aorta and peripheral vessels, a large brain, degeneration of the thyroid, a small vagina, and infantile uterus, with hyperplasia of the testicles and ovaries.

This condition lowers the resisting power of the organism, and the patients die usually early, in consequence of various acute infectious diseases and tuberculosis or nephritis, or diabetes—and suicides are frequent. The question whether the hypertrophied thymus is the cause or merely a symptom of this constitutional anomaly has not been solved.

Klose and Vogt sum up the state of knowledge about the thymus up to the year 1905. Extirpation of the gland does not influence the habit of animals, nor retard their growth, nor cause trophic disturbances or rachitic processes, nor retard the healing of the fractures. The relatively large edematous brain was early noticed and the theory of thymic asthma due to pressure upon the trachea and large vessels had been advanced in 1830 by Kopp. This theory was later opposed and entirely denied upon the authority of Friedleben, till in 1888 Grawitz re-established the former view.

The theory was founded upon hypertrophy and the changing turgescence of the gland, its capacity to become hyperemic, to press upon the trachea and hinder the return flow of blood to the heart by its pressure upon the large veins. Hyperemia has been mistaken for hyperplasia. The most severe congestion disappears after death and leaves no trace at autopsy. Stridor and death have been caused by an acute increase in size, due to hyperemia, the gland pressing upon the trachea, the vessels, and the nerves. The sternovertebral diameter is not more than one-half centimeter in children and though getting larger after the second year the space allotted to the thymus remains small and the chest walls are unyielding.

Rhen operated for a hyperplastic thymus in 1896 curing a case of laryngismus stridulus characterized by dyspnea and choking spells and since that time a number of thymectomies have been performed with curative results corroborating the old theory of pressure. Bash was the first to observe after thymectomy in animals a retarded growth, rachitic changes in the long bones, and changes in the psyche. Klose and Vogt who operated on fifty-four dogs with a perfected technique during the time of greatest development of the gland, namely on the tenth day, dividing the time after its extirpation into three stages: (1) the latent, lasting from two to four weeks; (2) the state of adipositas, lasting from two to three months; (3) the cachexia thymopriva and idiethia-thymopriva, lasting from the third to the fourteenth month. Death occurs during thymic coma. They insist that the

most favorable time of operation is between the tenth and twentieth day. After the third month only a small amount of glandular tissue can be found, which persists to the second and third year. The following are conclusions drawn from their exhaustive investigations: Thymic death is a general chronic tissue death, death with a prominence of adynamia, especially of the bones and brain. Severe chronic disturbances may be expected after thymectomy in children at the end of the second year, which will probably end with death at the time of puberty. Thymectomy should not be performed during the time of greatest development of the gland. Metabolism is not influenced by this operation, nor can blood changes be found. The skeleton remains dwarfed and the bones become elastic and fracture easy. Rhachitis, osteomalacia, and osteoporosis may be found in the same individual due to a decreased precipitation of lime salts, which is prevented by an increase of nucleinic acid in the system. The temperature is not influenced. Nervous disturbances are observed soon after operation. Motion remains awkward and slow, the animals tire easily and become paretic, coordination is disturbed, and the electric excitability of the nerves is decidedly changed, resembling the changes caused by tetany in children. Sensation remains long intact, but is gradually lost, and the senses, especially the sense of smell in dogs, become blunted. The skin reflexes are first increased, and later decreased, and the tendon reflexes already heightened in the latent state show a further increase later. In some cases a decrease may finally be observed. Psychic changes commence shortly after operation and progress till the animals pass into the idiotic state. Even in the latent state, the dogs lose their playfulness, and mental development is retarded. The perception of time and of space and the sensations of hunger and thirst are gradually lost, the dogs do not know their master, do not find the kennel, and dirty their place of rest, eat wood and stone and finally injure themselves. The brain is edematous and swollen, and microscopic examinations show degenerative and inflammatory changes in the nerves, cord, and brain.

The state of adipositas corresponding to the lymphatic diathesis in children is marked by a great accumulation of fat and by a hyperplasia of spleen, pancreas, thyroid, testicles, and ovaries. Children with a hyperplastic thymus have not alone to suffer from the pressure of the organ upon the trachea and vessels, but also from an intoxication, which gives rise to the lymphatic-chlorotic constitution (thymolymphatic state), a hyper-

plastic poorly functioning organ causes symptoms that resemble those due to its deficiency or absence. The loss of resisting power of infection and to psychic insults is the consequence. These children die often rapidly with the symptoms of shock.

The deficiency of lime salts in the bones after thymectomy, only half the normal, is due to an excess of acid. Their precipitation is caused by alkalies, their solution by acids. This suggests the hypothesis that the thymus through nucleinsynthesis, neutralizes phosphoric acid and its complicated compounds are set free in the growing portions of the organism. This explains the edematous condition of the central nervous system. Colloids swell in the presence of acid and water; they are found in every cell of the body and the cells of the brain are especially rich in these substances. An excess of acid causes edema. The edematous brain is a direct consequence of acid intoxication and acid neutralization through the function of the thymus is a life important process.

The gland is located in the interior mediastinum between the mediastinal leaves from which the internal artery and vein pass into it. It consists of a medullary and cortical portion and is surrounded by a fibrous capsule. A fine network of interstitial tissue, springing from the main capsule, divides the organ into a number of lobes and these into smaller lobes, and these again into follicles composed by adenoid and lymphoid tissue. Scattered in this are the concentric corpuscles of Hassal, which consist of a nucleated center, surrounded by flattened epithelial cells. The capsule is loosely fixed to the sternum and well grown to the fascia of the large vessels. The phrenic nerves and the pericardial phrenic artery border the thymus on both sides, which rests with its lower pole upon the pericardium, reaching usually to the fifth costal cartilage. The posterior surface lies upon the right auricle, accompanies the pericardium, ascending aorta, and aortic arch, and passes over to the pulmonary veins and reaches occasionally to the bifurcation of the trachea following the descending left innominate vein. It is in contact to the right with vena cava superior and right innominate vein, and rests above the left innominate vein directly upon the trachea, surrounded by the innominate artery, the left carotid artery and the jugular vein. The pneumogastric and recurrent laryngeal border it on the left. Branches of the internal mammary, inferior thyroid, the pericardial phrenic artery, the innominate and the superior thyroid, supply the gland with blood, while only a single network of veins empties into the internal mammary vein. This decided

disproportion between the afferent and the efferent vessels is of special interest, considering that the organ is in direct connection with the aorta and that it shares in every disturbance of the general circulation. Attention has been called to this feature by Klose and Vogt and previously by myself. The lymphatics are large, arise in the substance of the gland, and are believed to terminate in the jugular vein.

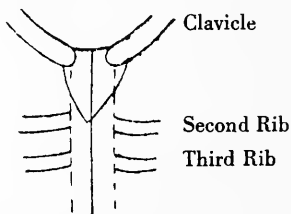


Figure 1—Thymus Dullness (after Friedjung, Klose and Vogt).

In the present state of our knowledge of the thymus, it is important to diagnose its diseases. Surgery may be lifesaving when the organ is hyperplastic—the thymolymphatic state. The stridor and the asthma are of great importance in the diagnosis of thymic hyperplasia and wasting in thymic atrophy. The examination with the Roentgen rays aids in some cases though it is unsatisfactory in most. According to Bash, and Bohm, it is impossible to make out with the X-rays the thymus in children, but hyperplasia of the organ can be diagnosed by this means.

Percussion gives good results and thymic dullness can be made out with accuracy in children. Park states in his article on this subject, published in 1912, that the area of dullness mapped out by Sahli and modified by Blumenreich holds today. I have shown with Oestreich in a number of experiments on the cadaver, that not alone the absolute dullness, but also the relative dullness, that is, the whole form of the gland, can be mapped out in *children* and in *adults up to old age*, when my method of percussion (drop method) is used.

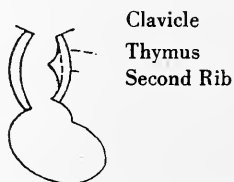


Figure 2—Child eight months' old. Died of Bronchitis and Severe Intestinal Catarrh.

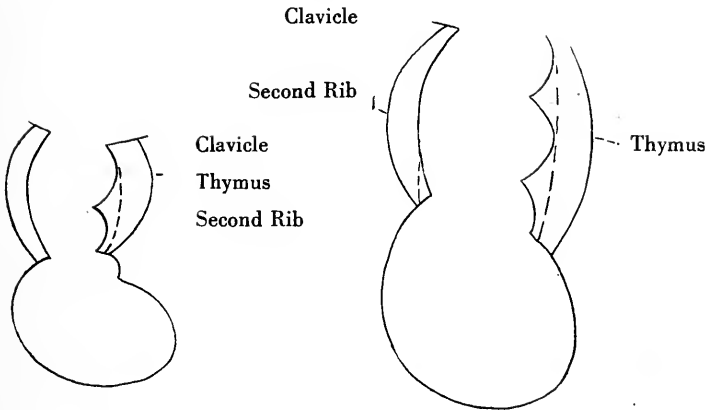


Figure 3—Thymus, Heart Pericardium and Vessels of a Child six years' of age.

Figure 4 — Thymus, Pericardium, Heart and Vessels of a patient who died of General Tuberculosis. Percussion of Thymus on the Cadaver after Formaline Injection into the Femoral Artery. Only after such an injection can the gland be percussed after death.

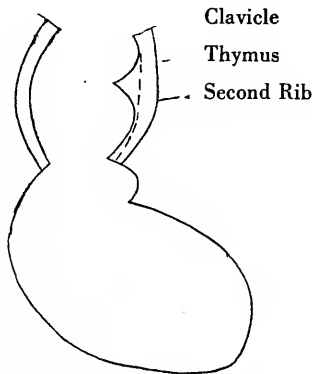


Figure 5—Thymus. Heart and Pericardium and Vessels of a man seventy-six years of age.

Thymus extract increases the symptoms of intoxication and alkalies given in sufficient quantity neutralize the excess of acid and may stimulate alkali production. The feeding of the gland to normal animals increases their nervous excitability. The extract has been successfully used in the treatment of simple goiter; its administration does not cause hyperthyroidosis. Miculicz, who was the first to use it in this disease, also reported

cases of exophthalmic goiter treated with favorable results. His experiments have been only partly confirmed.

Probably good results are obtained when hyperplasia is associated with degeneration and a poorly functioning activity. A number of other affections have been treated with thymus extract. In infantile marasmus, when atrophy of the thymus is present, which is usually the case, the medication gives good results. In rachitis, it is said by some and denied by others, that the insufficient ossification of bone is benefited by the extract. The function of the thymus is of importance to stimulate the growth in childhood.

THE SUPRARENALS

These organs have been first described by Eustachius in 1563. They were closely studied by observers following him, and the names of many noted physicians are connected with them. In the three centuries following their discovery, nothing was known of their physiology, though the knowledge of their microscopic anatomical structure was completed and the study of their histology has been well advanced, especially through the work of Koelliker in 1854.

Thomas Addison published in the following year his celebrated treatise "On the Constitutional and Local Effects of Disease of the Suprarenal Capsules", in which he considered the disease and consequent failure of these organs to act, as the cause of death. He was the first to point out the vital importance of the suprarenal bodies and to record the first observations of their function. Experiments on animals followed and though the extirpation of these glands did not cause the typical picture of Addison's disease, it was invariably followed by death, leaving no doubt as to their vital importance.

The suprarenal bodies are ductless glands, triangular in shape and of a yellowish color, resting with their lower border upon the upper borders of the kidneys. They are surrounded by a sheath of connective tissue, from which fine prolongations pass into the glands, forming a frame work. They consist of a cortical and a medullary portion. The cortical portion is divided into columnar groups of cells, rich in fat globules and these into zones. The Zona glomerulosa, situated next to the capsule, is followed by the Zona foveolata and the reticular is next to the medullary portion. The blood vessels are distributed in the fibrous septa between the columns and do not penetrate between the cells. The

medullary portion, darker in color and softer than the cortical portion, consists of an irregular net-work of fibrous tissue with numerous blood vessels and nerve fibres. In the alveoli, formed by fibrous tissue, are imbedded a number of large irregular shaped cells, highly vacuolated, and free from fat globules. These cells resembling the ganglionic cells of the sympathetic ganglia, stain readily with a solution of bichromate of potash and have been called chromaffine or chromophile. The suprarenal bodies are neither morphologic, genetic physiologic, nor pathologic uniform organs.

The characteristic feature of the cortical portion is its richness in fat globules and that of the medullary portion, the chromaffinity of its cells. The suprarenals are present in all vertebrate animals, but as we descend the scale, they differ in structure and arrangement, and their two portions are found in fish entirely separated as *interrenal* and *adrenal* systems. The interrenal system is derived from the mesoderm and corresponds to the cortical portion of the higher vertebrae. The adrenal system corresponding to the medulla, is epiblastic in origin, corresponds to the sympathetic system and is a part of it. The development of the suprarenals represents a union of two systems in the higher developed animals. Accessory suprarenals are frequently found and their occurrence is readily explained when the origin of these organs is remembered. They may be adherent to the main bodies or scattered about in the solar plexus, or lying near the coeliac ganglia in the cortical portion of the kidneys, or near its surface, etc.

The attempts to produce Addison's disease with experiments on animals date back to Brown Sequard, who though not able to produce the disease, came to the conclusion that extirpation of the suprarenals causes death of the animals. These investigations were confirmed by many observers, who also found that the removal of one of the suprarenals causes hypertrophy of the other and of the accessories. This explains the occasional survival of animals after an apparently complete removal of the gland. The compensatory hypertrophy of one of the adrenals after the removal of the other, makes this operation comparatively harmless, whereas death following the extirpation of both adrenals, proves their vital importance. It is immaterial whether the organs are removed at the same time or at intervals. A partial destruction of the suprarenals interferes but little with the health of the animal. The question whether the medullary or

cortical portion is of vital importance, or both, has not been settled. It has long been known that adrenalin, a blood pressure increasing substance, is produced by the medullary portion and that it passes continuously during life into the blood. It was thought that adrenalin influences the nervous centres which preside over respiration and over vascular and muscular tone of the body, and that the cause of death of the animals was due to the absence of this substance. The blood pressure sinks after the extirpation of the organs or ligation of the suprarenal veins, but rises, however, to the normal, in less than half an hour. The experiments in this direction only prove that adrenalin passes constantly into the blood. The hypertrophy of accessory suprarenals, which consists solely of cortical tissue, tends to show that this substance, as well as the medullary substance, is of vital importance. Biedl found that animals survive the operation, if a small portion of the cortex is left, and comes to the conclusion that though the vital importance of the medullary portion is shown from its well defined physiological action, the complete or partial decapsulation proves the vital importance of the cortex. Animals do not need the medulla of the suprarenals to survive. They possess extra capsular chromaffine tissue in sufficient quantity. Biedl's experiments on fish, which allow a complete extirpation of the interrenal system, on account of the separate arrangement of the interrenal and adrenal systems, seem to prove his views as to the vital importance of the cortical substance conclusively. The animals whose interrenal system had been removed showed increasing muscular weakness and paling of color, and invariably died in less than three or four weeks. The autopsies showed no other cause for their death.

The most prominent symptom presented by decapsulated animals are apathy and muscular weakness, which towards the end increases to complete paralysis. The animals die in prostration. Further mentioned are fall of temperature, loss of weight and toxicity of the blood, which can be neutralized with adrenalin extract. Prostration and death have been thought to be due to intoxication and on this account the function of the suprarenals to consist in the neutralization of catabolic toxins. A partial or complete destruction of the suprarenals through hemorrhages are not rare in men and Virchow was the first to call attention to it. They are caused by trauma, thrombosis and embolisms—rarely by suppuration. Severe nervous and peritoneal symptoms appear and cause rapid death. In subacute cases pigmentation of the

skin follows. Chronic degeneration of the suprarenals due to atrophy and cirrhosis are caused by tuberculosis, syphilis or malignancy. They produce the symptom complex of Addison's disease. The typical pathology of this is tuberculosis of both suprarenals, though cases have been reported with healthy organs. Wiesel thinks the disease of the medulla the cause of "Addison's disease" and reports six cases, in which he found a degeneration of the medullary portion of the suprarenals, as well as the extra capsular medullary tissues connected with the sympathetic. This explains the cases reported with adrenals intact and of adrenal disease without the symptoms of Addison's disease.

The question has not been settled and most observers still believe that the disease of the whole organs, cortical and medullary portions is the cause of this disease. They explain the cases of healthy suprarenals occasionally found with an affection of the secretory nerves and those with diseased suprarenals, but without Addison's symptoms, with extra capsular functioning tissue affected. In the majority of cases of Addison's disease the suprarenals have been found degenerated. The disease begins insidiously with gradual and progressive loss of strength and emaciation, accompanied by apathy and inaptitude for mental work, easy fatigue and prostration without apparent cause, the pulse becomes feeble and gastro intestinal disturbances, loss of appetite and vomiting are noted, which may become frequent. The most prominent feature is the bronzing of the skin. The discoloration is not removed by pressure and affects especially the axillae, the inner surfaces of joints, the median line, the areas around the nipples and the mucous membranes of cheeks and lips. Cornea and finger nails remain free from discoloration. As mentioned before, the discoloration of the skin is not present in all cases. Animal experiments do not explain the symptoms. Bronzing of the skin never follows decapsulation, though muscular weakness, apathy and emaciation, prominent symptoms of Addison's disease, follow the removal of the suprarenals in animals.

Feeding of decapsulated animals with adrenal extract preparations or treatment with hypodermic injections of the extract have not given encouraging results. This mode of treatment has been successful in some cases of Addison's disease, though in many others, it has totally failed. Adams has collected the report of one hundred and five cases treated by means of grafts and ingestion or injection of suprarenal extract. Of these seven cases were followed by alarming and fatal results, which

he thinks, however, not due to the treatment, but due to the disease itself. In forty-nine cases no benefit or doubtful results were obtained. In thirty-three cases the treatment was followed by marked improvement and sixteen cases were apparently permanently cured. Allowing for spontaneous improvement and recovery, rest in bed, and other modes of treatment and mistaken diagnosis, he quotes six cases in which relapses occurred as soon as the medication was discontinued. According to this, the results of organotherapy in Addison's disease are varying and in most cases disappointing.

Grafting has been extensively tried on animals by Haberer and Stork, who report 50% of their experiments as being permanently successful. Cortical and medullary portions of the grafted organ remained alive and performed their functions. Grafting has not only furnished additional proof of the vital importance of the suprarenals and of their internal secretory function, but also promises results in cases of suprarenal disease in which medication with the extract has failed.

The chemistry and function of the suprarenal extract has been thoroughly studied. The toxicity of the extract was early shown and led to the theory that the function of the suprarenals consisted in neutralizing the toxic neurin, a product of decomposition of nerve tissue. This theory, not confirmed by further experiments, was soon abandoned. J. Takamine succeeded in 1901, after a great deal of work had been done by previous investigators, especially after the publication of Oliver and Schafer of the rise of blood pressure following intravenous injection of suprarenal extract, in producing a specific substance from the medulla of suprarenal bodies, which he named "Adrenalin" ($C_{10} H_{15} O_3$) and which possessed the active properties of suprarenal extract. It is a light microcrystalline substance, slightly bitter, sparingly soluble in cold water, freely in hot water, stable in a dry form, of slightly alkaline reaction and combines with various acids. It is a powerful reducing agent. Stolz produced a substance synthetically possessing the same properties, and giving the same reactions as adrenalin. It differs from the natural product, however, which turns the polarized ray to the left, whereas the artificial product is optically inactive. Iron chlorid turns adrenalin green and a watery solution of iodine rose-red, reactions useful for analytical purposes. A number of methods have been devised to determine the presence of adrenalin qualitative and quantitative. The physiological action upon the organism has been

well studied; most characteristic is its effect upon the vascular apparatus. An intravenous injection of adrenalin is immediately followed by increase of blood pressure and slowing of pulse, rapidly followed by falling and returning to the initial state in a few minutes. The increase of blood pressure is far greater when atropin is administered at the same time, to paralyze the pneumogastric and prevent pulse slowing. The increase of blood pressure is usually proportionate to the amount of adrenalin injected and is first of all due to a stimulation of vasoconstrictors and consequent narrowing of the peripheral vessels. The surface pales and spleen, kidneys and intestines decrease in size, whereas the extremities increase. The vessels supplied by the splanchnics are mainly affected and least of all those of the extremities—the brain, lungs and coronary arteries of the heart, which passively dilate. The coronary vessels of the heart do not contract at all and are an exception to the general rule, which is very important when adrenalin is used for therapeutic purposes. The same effect is obtained when adrenalin is applied locally. A hyperemic area can be made anemic and the therapeutic action of adrenalin is largely based upon this property. It passes but little through epithelial covering of the skin and mucous membranes and has to be injected. Adrenalin acts upon the capillaries. The large vessels do not contract. The increased peripheal resistance causes the rise of blood pressure and through the contraction of the splanchnics a better circulation and filling of the coronaries is obtained when heart weakness and paralysis of the vessels have lowered blood pressure. It is especially indicated in collapse, chloroformnarcosis and conditions that demand toning of heart and vessels. Langley and Elliott advanced the idea that the action of adrenalin is that of the sympathetic, stimulated by electricity. If the sympathetic increases the activity of an organ, adrenalin will do so and if inhibiting, this substance will do the same. The action of adrenalin to cause contraction of all peripheral vessels, with the exception of the coronaries of the heart, which dilate, corresponds to the action of the sympathetic, which supply the peripheral vessels with vaso-constrictors and the coronaries with vasodilator fibres. Its effect upon the heart is toning, it accelerates and strengthens contractions. This is best shown when the slowing action of the vagus is eliminated by a simultaneous application of atropin. If apocodeine is applied instead, which paralyzes vagus and sympathetic fibres, even large doses of adrenalin lose their strengthening effect, proving that this substance acts

upon the end fibres of the sympathetic and their neuro-muscular mechanism. The action of adrenalin upon the gastro-intestinal canal is identical with that of the sympathetic; inhibits and relaxes peristaltic movements, with the exception of the sphincter of the pylorus, the ileo cecal, and internal anus, which contract. The vagus tones and increases peristalsis.

Elliot found that the action of adrenalin corresponds to that of the sympathetic upon the bladder and as this varies very much in different animals, it is especially suited to prove the identical action of both. An intravenous injection of adrenalin causes anemia and contraction of the external genital organs and the uterus. The contractions of the womb are especially powerful during pregnancy and may cause abortion. Post-partum hemorrhages may be arrested by adrenalin injections directly into the organ. Sympathetic fibres have not been demonstrated in the muscles of the bronchi innervated by the vagus, the stimulation of which causes contraction, upon which adrenalin has no effect. Its beneficial effect in asthma is explained by stimulation of the sympathetic, compensating the vagustonus, the cause of the asthmatic attack,—contraction of the bronchi. The effect of an intravenous adrenalin injection upon the eye is exactly that which follows electric stimulation of the sympathetic, that is, opening of the lids, protrusion of the eyeballs and dilatation of the pupils. The adrenalin reaction upon the dilator of the pupil is so sensitive, that it acts in a dilution of 1:20 millions and the reaction is used for quantitative determination of adrenalin. The enucleated bulbus of the frog is employed and with it, the presence of the most minute quantities of adrenalin can be determined in blood and urine.

However, as various other substances give this reaction, the result has to be controlled with other biologic and chemic methods. Adrenalin increases the activity of various glands, the secretion of saliva, of bile and of pancreatic juice and it has a marked effect upon the kidneys, the volume of which decreases, due to the contraction of the numberless capillaries, accompanied by diminution or suppression of urine, followed by vasodilatation, increase of volume of the organs and polyuria. The increase of lymph flows from the thoracic duct and can be similarly explained by circulatory changes. If adrenalin is hypodermatically injected, its rapid absorption is prevented by capillary contraction, and rise of blood pressure does not occur. Adrenalin influences the composition of the blood by decreasing its alkalinity, increasing specific gravity

and producing a leucocytosis, with increase of neutrophile and polynuclear cells and diminutions of the eosynophiles. Adrenalin glycosuria has been known since 1901, when Blum discovered that a subcutaneous injection of from one to two Mg. adrenalin is followed within half an hour by elimination of sugar in the urine. The glycosuria is accompanied by a hyperglycemia and lasts several hours. An intravenous injection produces hyperglycemia, just as the subcutaneous injection, but a simultaneously diminishing diuresis, prevents the sugar from appearing in the urine.

The rise of blood pressure lasts as long as adrenalin is present in the blood and so does the glycosuria, and as adrenalin is a very easily oxydized substance, it is understood why the effect of adrenalin is only temporary. Both rise of blood pressure (vasoconstriction) and glycosuria are caused by its action upon the sympathetic. The latter resembles the effect of Claude Bernard's puncture, which acts, however, centrally, whereas adrenalin acts upon the peripheral fibers of the sympathetic. The close relation of the suprarenals, Pancreas and Thyroid is well established. Adrenalin acts inhibiting upon pancreas function and, vice versa, adrenalin hyperglycemia and glycosuria can be diminished and suspended by pancreas secretion. Adrenalin glycosuria cannot be produced after thyroidectomy. Albumin, fat and salt metabolism is increased by adrenalin injection, the temperature rise is not fully explained. The latter may be due to increase of heat production or diminished heat loss, or it may be caused by the action of adrenalin upon the peripheral fibres of the sympathetic, which increase heat tonus, similar to the effect of the heat puncture, which acts centrally. The influence of adrenalin upon medullary centers affecting pulse and respiration, slowing the former and causing shallow respiration, or decreased frequency, have been explained by circulatory changes and not by direct central stimulation. Adrenalin administered in larger doses is toxic; its poisonous effect varies with different animals and with the mode of application. It has to be used with caution for therapeutic purposes, as subcutaneous injections not larger than one Mg. have caused headache, palpitation and chills in old people. A large intravenous injection in various animals is followed almost immediately by death, due to severe circulatory disturbances but when injected into the subcutaneous tissue or peritoneum, it causes necrosis at the place of injection and an intense hyperemia, inflammatory changes and hemorrhages in almost all internal organs. The same occurs after repeated intravenous injections of adrenalin or suprarenal extract.

The effect of suprarenal preparations upon the blood vessels is marked and it is now unanimously admitted that continuous use causes atheroma, sclerosis and fatty degeneration of vessel walls, especially of the aorta, due to rise of blood pressure and its direct destructive effect upon the tissues. It is a product of the adrenal system, of the medulla and of those cells that are characterized by their affinity to chrom, staining brown with bichromate solution. This coloring reaction has been used to estimate the amount of adrenalin in the medullary substance. More exact methods for quantitative analysis have been devised since.

Excessive muscular work diminishes the amount of adrenalin in the system and the various acute and chronic infectious diseases cause pathologic changes in the suprarenals and their production of adrenalin. Biedl examined two cases of Addison's disease and found that the extract prepared from the suprarenals did not cause rise of blood pressure. The varying amount of adrenalin found and the work of many investigators, leave no doubt that it is constantly secreted during life and that it continuously passes by way of the suprarenal vein into the general circulation, so that the blood always contains it. A minimal portion is eliminated by the kidneys, a larger portion is destroyed by the alkalinity of the blood in the blood itself. Adrenalin is readily oxydized in all alkaline solutions. Kretchmer succeeded in prolonging the effect of adrenalin, raising the blood pressure six times by the intravenous injections of an acid into a rabbit. *This is a very important point in the treatment of acid conditions of the blood, found so frequently associated with high blood pressure.* Further destruction of this substance takes place in the tissues and organs of the body, especially in the liver. At intervals, repeated injections of large doses of adrenalin do not cause continuous high blood pressure, though this effect has been obtained for several hours with a constant flow of a very diluted solution of the substance into the circulation. Arteriosclerosis and cardiac hypertrophy accompanying chronic nephritis have been explained with an excessive activity of the medullary portion of the suprarenals; however, this has not been fully proven. On the other hand, an excess of adrenalin is always found in Basedow's disease, of which high blood pressure is not a usual symptom.

This powerful substance produced in the chromafine cells and continuously passed into the blood, toning and regulating the function of the sympathetic, has been widely used for therapeutic purposes. Operations have been performed under local

anesthesia by means of adrenalin and cocaine or eucaine injections and general anesthesia for major operations has been produced with injections of cocaine and adrenalin into the spinal canal. Adrenalin prevents the toxic effect of cocaine, according to a number of observers. It has to be used with great caution in patients that suffer from arteriosclerosis and nephritis. In the treatment of the eye, nose and throat and in operations on gums and teeth, it is used with great advantage. Applications to bleeding surfaces arrest the hemorrhage and it is effective in epistaxis, either by painting the mucous membrane of the nose or applying it on gauze. The congestion of hemorrhoids is benefitted by adrenalin applications and bleeding promptly relieved. Bleeding from the stomach in gastric ulcer and from the uterus and from the rectum, have been relieved by adrenalin administration by mouth in thirty drop doses of a solution of 1:100 every three hours. Similar favorable results have been obtained in the treatment of haemophylia and purpura. Notwithstanding the fact that suprarenal preparations have but little influence upon the vessels of the lungs, numerous cases of haemoptysis, in tuberculosis, arrested by adrenalin, given by mouth or hyperdermic injection, have been reported. Its employment as a cardiac and vascular tonic and in asthma with atony of vessels, has been mentioned. Arteriosclerosis and myocarditis are contra-indications for its use.

I have used adrenogen—the tablets made of the dry cortex of the suprarenals, in a case of myocarditis, in which digitalis in its various forms and other heart tonics, had completely failed, with good results. The formerly very irregular rapid pulse became almost regular and from up to two hundred beats per minute, the heartbeat slowed down to between ninety and a hundred beats. The heart is now normal. The formerly distended abdomen of a very small woman became decreased in size. It measured, before the administration of adrenogen, thirty-six inches and at present twenty-seven inches. The urine was free of albumin and sediment and was voided in varying, usually sufficient, quantity. The general nutrition of the patient improved correspondingly.

The same preparation has been used by Little with some success in cancer of mesodermic origin.

I have a patient under observation who had a large malignant ovarian cyst removed in March, 1914. During the removal of the cyst, the membrane broke and a cupful of the contents filled with cancer-cells passed into the abdominal cavity. Under general treatment and cacodylate of soda injection, she remained

free of signs of recurrence. Since May, 1916, I have given her in addition adrenogen—three tablets a day. The patient is now, twenty-one months after the operation, apparently in perfect health and weighs twenty-six pounds more than at the time of the operation.

Diabetes insipidus, considered to be due to vasomotor disturbances has been relieved by suprarenal preparations, and selected cases of exophthalmic goiter, of infectious fevers with low blood pressure and other affections, have been benefitted by the administration of adrenalin.

Little is known of the function of the cortical portion, the interrenal system, in fact, nothing certain, except that it is of vital importance and that life cannot exist without it. It is of mesodermic origin and characterized by the fat granules contained in its cells. With the adrenal system it is present in all vertebrates and in the higher developed animals and men, it is united with the former in the suprarenal bodies, though, as has been mentioned, accessory suprarenals, resembling structurally the cortical portion, are very frequently met. A relation has been found to exist between the genital organs and the suprarenals; castration and pregnancy cause their hypertrophy. The growth after castration is due to growth of the cortical portion and during pregnancy to hypertrophy of the whole organ, though it is more marked in the cortex, and it is thought that the suprarenals, especially their cortical portion influence the development during adolescence. In their contents of globulins and nucleoproteides the suprarenals do not differ from other organs. These are found in all. Choline was discovered by Lohman in the suprarenals and it was found that the cortical portion is especially rich in this substance. However, its presence in many other organs was long known and though it was formerly thought to act by lowering blood pressure, it was later shown that it does not do so, and that it is not a characteristic product of the suprarenals nor is it antagonistic to adrenalin. So far only the fat granules found are considered specific of the cortical portion, their microchemic reactions differ in many points from those of pure fat granules. The question as to their constitution and function has not been settled. It is thought by some authors that it neutralizes fatigue toxin and other metabolic products of the organism. The influence of the cortical portion upon the development of the testicles and ovaries, and upon growth and development during puberty, speaks in favor of an internal secretion, which has not been isolated as yet. Though nothing certain is known as to the

function of the suprarenal bodies as "uniform organs," the idea has been advanced that the products of neutralization of fatigue toxins in the cortex forms the origin of adrenalin, and that this is deposited in the medulla, from which it continuously passes into the general circulation.

THE PITUITARY BODY OR HYPOPHYSIS

That the pituitary body is a secretory gland has been the view held by the physicians of past centuries. Galen thought that the mucous (pituita) secreted by the brain, was excreted by this organ. Later Willis and others held that the secretion of the cerebro spinal fluid was the function of the hypophysis and Magendie, in 1847, considered it an organ, which had to collect the lymph from the brain and pass it into the circulation. Liegeois in 1860 classed it with the blood making glands and supported his view with histological findings.

Since the publication of Marie and Marinesco in 1886, that acromegaly is constantly associated with a pathological condition of the hypophysis and since it had been found that this organ hypertrophies after thyroidectomy, the hypophysis has been considered belonging to the internal secretory organs. This view was confirmed by Oliver and Schafer's discovery of the physiological properties of its watery extract. The hypophysis is a small reddish gray mass, lying in the sella turcica (Turkish saddle) of the sphenoidal bone and consists of two lobes, an anterior kidney-shaped, resembling the thyroid, and a small posterior one made up of nerve tissue, which in the most highly developed animals and men consists mostly of a mass of fibrous vascular tissue. It is connected by a cord of similar tissue with the floor of the third ventricle, where it forms the infundibulum.

The sella turcica, upon which the hypophysis rests, is lined by the dura mater, which also covers this organ, forming a fibrous capsule with a small circular hole in the centre, through which the infundibulum passes. Both lobes are derived from the epiblast, the anterior from the portion lining the buccal cavity. It consists of a frame-work of interstitial tissue, in which are placed convoluted cords of cells arranged in groups. The anterior lobe resembles a secretory gland. Two different types of cells are found in it, which may be differentiated by their form, size and color reactions. They are chromophiles, some of which are round, contain a large number of very fine granules, stain

well with eosine and their small nuclei often central, stain with haematoxyline, "Eosinophile cells". The others are larger in size, stain dark blue with beamotoxyline, contain larger granules and nuclei and have vacuoles in their cell body—cyanophile or basophile cells.

The second group of cells, the chromophiles—main cells—are characterized by ill-defined contours and a large, round, irregular nucleus. The arrangement of these various cell-groups is not constant, though usually the eosinophiles are found in the posterior portion of the anterior lobe and the basophiles in its frontal portion; the main cells have no regular topographic arrangement. The hypophysis gains considerably in weight and size during pregnancy and decreases after birth, due to the appearance of new cells (pregnancy cells), derived from the main cell, which disappear altogether after birth. The pregnancy cells contain large irregular nuclei and a granulated protoplasm, which stains well with eosine and changes after birth again into main cells. In the frontal lobe are occasionally found small follicles containing a colloid, resembling that of the thyroid. The posterior lobe, considerably smaller than the anterior, consists mainly of neuroglia and is mixed with interstitial fibres. It has been found to contain nerve cells and fibres. The pituitary body resembles closely in structure a glandular organ with internal secretion. At present, it is unanimously accepted that the fat granules found in every cell increasing in size with age are a product of cellular secretion and the cell granules, are considered another secretory product. The views as to the colloid substances differ. Some investigators consider it a product of degeneration and others a rudiment of the time when the organ had to perform excretory functions. To settle the question as to the function of the hypophysis, a large number of hypophysectomies have been performed. The earlier experiments are valueless on account of a faulty technique. The more recent operations after the method of Pandesco prove beyond question that the pituitary body is a vital organ, the removal of which is invariably and rapidly followed by death. The extirpation of the posterior portion is well borne and can be done without disturbance of general health.

A partial removal of the anterior lobe does not cause death, but gives rise to an increased deposition of fat, polyuria, transitory glycosuria and falling out of hair. Sexual power is decreased, with an accompanying atrophy of ovaries and testicles. An acute hypertrophy of the thyroid has been occasionally observed to fol-

low the operation. Cushing considers from his experiments, the anterior lobe to be the vital portion, the partial removal of which causes disturbances of growth, of fat metabolism and of the sexual apparatus. Biedl confirms these observations, and finds that the removal of the posterior lobe, does not prove fatal to animals for several months, but that they die later from intercurrent diseases. These various disturbances can be especially well observed when the partial removal of the anterior lobe of the hypophysis is performed in young dogs. They gain in fat, which may lead to a universal adiposity and show inhibition of growth, coupled with an infantile habitus and their testicles and ovaries remain small.

The definite physiologic action of the extract first shown by Oliver and Schafer confirm the view that the hypophysis belongs to the class of the internal secretory organs. These observers found that an intravenous injection of the extract is followed by a considerable rise of blood pressure of longer duration than that caused by intravenous injection of suprarenal extract, though not as high. The rise is due to capillary contraction and improvement of cardiac action. It further differs from an injection of suprarenal extract by not causing slowing of pulse when the pneumogastric is intact and not increasing pulse frequency when these nerves are cut—on the contrary, the pulse is slowed. These observations have been confirmed by a number of investigators, and it has been added, that the substance is especially contained in the posterior lobe, and that a second injection has no effect on the blood pressure. It slows and strengthens the contractions of the heart, partly due to a central nervous excitation upon the vagus, and partly due to a direct action upon the heart muscle. The slowing takes place after the cutting of the nerves as well. It also has been demonstrated that the extract of the posterior lobe contains a second active principle, which causes lowering of blood pressure; however, it has not been finally determined whether this blood pressure lowering substance is a specific product of the gland. Magnus and Schafer report increase of diuresis after an intravenous or subcutaneous injection of the extract obtained from the posterior lobe, and Johnson found, experimenting on dogs that feeding with pituitary substance increases the output of nitrogen, urea and phosphates, the animals losing weight at the same time. Schiff finding after administration of pituitary substance to elderly men and to patients suffering from acromegaly, excessive elimination of phosphates, and nitrogen output little

altered, concludes that the hypophysis presides over the nutrition of the osseous system. Bones are rich in phosphates and poor in nitrogen.

Delille produced in four rabbits injected with the extract, a considerable deposition of fat.

Very valuable information as to the function of the hypophysis was obtained from the study of acromegaly, first described by P. Marie in 1886, and found by him to be constantly associated with disease of this organ. The disease commences usually slowly and insiduously with muscular weakness, apathy, pains and paresthesias, followed by thickening and enormous enlargement of hands and feet, of nose, lips and lower jaw, due to bony growth and swelling of the soft portions. The long bones are little affected and very large hands and feet may be attached to slender arms and legs. Clavicle, sternum and spine are usually thickened and a kyphosis is an almost constant symptom. The changes on the head are pronounced. The protruding lower jaw and the retreating forehead, the thick and flattened nose, the thick lips and tongue, give a characteristic appearance to the patient. The thyroid is sometimes enlarged, and sometimes small. The changes come gradually in the course of years and it is difficult to make an early diagnosis. The patient moves awkwardly, is apathic and shows loss of energy, and is affected by somnolence. Polydipsia, polyuria and glycosuria are frequent symptoms. Gradually symptoms of a cerebral tumor of basal origin appear. Headache, dizziness, vomiting, loss of intelligence, disturbances of sight, bitemporal hemianopsia, amblyopia and amaurosis are prominent symptoms. The fundus, normal in the beginning, shows atrophy of the optic nerve, but rarely a choked disk. Exophthalmos is often observed. Hypoplasia of ovaries and testicles are frequent. Roentgen ray examination aids in making the diagnosis by demonstrating changes in the bones. Though the course of the disease is usually very chronic, acute cases have been reported with death, due to intracranial pressure. The pathological changes so constantly found in the pituitary body are the most marked feature of the disease, and consist usually of hyperplasia and tumors, adenoma, adenocarcinoma and sarcoma. Marie advanced the theory that the changes were caused by lack or insufficient functioning of the hypophysis, being led to this conclusion by the destructive processes he found in this organ. Tamburini explained the changes produced by the disease, with hypertrophy and over function of the organ, followed by degen-

eration and consequent cachexia. It may be considered or proven that acromegaly is at least partially caused by the over action of the pituitary body. Operative surgery has brought further proof to bear on this supposition. Hochenegg extirpated a hypophysis tumor in 1908 and succeeded by this operation in curing his patient. Five days after the operation the headache ceased, and the disturbances of vision disappeared and a few days later, hands and feet became smaller. Within three months the cure was complete with the exception of a slight swelling of the soft portions. The menstruation returned and six months after the operation an enlargement of the thyroid was noticed. The excised tumor proved to be a malignant adenoma, free of the chromophile cells. Cushing reports a case in 1909, of a partial hypophysectomy, followed by a measurable diminution of hands and feet and Exner published another case of acromegaly from Hochenegg's clinic, followed by cure, after extirpation of a malignant hypophysis tumor. If the view of hypersecretion of the pituitary body in acromegaly is correct, it is readily understood that the treatment of the disease with the extract has not given any favorable results. A large number of experiments have firmly established the fact that this organ acts in close relation with ovaries and testicles, the suprarenals, the thyroid and the thymus, which is found often to persist in acromegaly. Another disease closely associated with acromegaly is gigantism. This is an anomalous growth of the skeleton, characterized by morphologic and functional disturbances. These patients have long legs and arms, the legs especially are long, out of all proportion. The trunk is but little affected and the head appears small. The pituitary body is usually found enlarged, due to hyperplasia, though adenoma and epithelioma have been observed with it. The genital apparatus is undeveloped and shows an infantile character; ovaries and testicles are atrophied. Symptoms and pathology resemble acromegaly. Brissaud defines gigantism as acromegaly of the period of development and acromegaly as gigantism after that period and like acromegaly it is due to hyperfunction of this organ—the pituitary body. Bartels has described a disease caused by hyperfunction of this organ; obesity, associated with a tumor of the hypophysis and an infantile character of ovaries and testicles. A number of such cases have been published since, characterized by obesity, dryness and low temperature of the skin, hypoplasia of the genital apparatus, infantilism and symptoms of a cerebral tumor at the base of the brain. Cushing, Aschner and Biedl have succeeded in produc-

ing obesity in animals after a partial hypophysectomy, leaving no doubt that the cause of the disease is hypofunction of the pituitary body. The treatment with pituitary extract has given favorable results. If on the other hand, extirpation of the tumor has cured the disease, it can be explained that after the operation the function of the organ has been resumed. As already mentioned, the treatment of acromegaly with pituitary extract, has not been satisfactory. This is to be expected when the cause of the disease, hyperfunction of the organ, is considered. Horsley has proposed hypophysectomy in these cases to remove the cause. Heart disease has been treated with pituitary preparations with some success.

With our present knowledge, it may be accepted as a well established fact that the pituitary body is an internal secretory organ of vital importance to the organism, and that the removal of the frontal lobe is followed by death, whereas, the extirpation of the posterior lobe is not followed by serious consequences. The organ acts in correlation with other internal secretory organs and pathologic changes in these cause changes in the pituitary body. Hypoplasia of ovaries and testicles and of the thyroid are accompanied by hyperplasia of this organ. Finally overfunction of the hypophysis stimulates growth of bones and soft tissues and hypofunction causes a deposition of fat. The extract obtained from the posterior lobe has definite physiological properties. It has not been proven, however, whether this substance is produced during life.

Pituitary extract is at present widely used. The following conditions are enumerated by Hofstaetter, in which the administration of pituitary extract has given favorable results:

Collapse, postoperative shock, acute infectious diseases exhibiting marked recession of blood pressure, hypophysia (the symptom-complex as constructed by Martini), paroxysmal tachycardia, myasthenia, eclampsia, puerperal and postoperative retention of urine, and postoperative intestinal paralysis. Furthermore, since injections of pituitrin have been observed to induce a condition of somnolency, it is recommended for insomnia and neurasthenic conditions. In combination with adrenalin, pituitrin controls bronchial asthma. Osteomalacia and rickets yield to this therapy. Some have observed increased libido following its use, employing it in impotency, while others believe it to allay sexual irritation.

Other conditions for which pituitary gland has been advised and in part tried are: acromegaly, dystrophia adipositas genitalis, multiple glandular sclerosis, Dercum's disease, exophthalmos, myxodema, goiter, scleroderma, Addison's disease, tetany, myasthenia, tachycardia, chondrodystrophia, ateliopsis, micromelia; while the following come under the head of gynecology, namely, uterine hemorrhage, hypoplasia, amenorrhea, climacteric and post-gestation disorders, vomiting and toxicoses of pregnancy, deficient lactation.

I have treated consumption in patients of the paralytic type with pituitary extract, adding this to the usual treatment and have obtained excellent results. It seems that the gland presides over the work of all others. A marked increase of blood pressure I have not observed; in fact, in some cases I have seen blood pressure lowered.

Little gives the extract of the ductless glands, according to the origin of the cancer (his theory) ectodermic, mesodermic, or endodermic.

For ectodermic cancer, pituitary extract; for mesodermic, the suprarenal cortex, and for endodermic cancer, the islands of Langerhaus.

He claims that under the administration of pituitary extract, ectodermic cancer has disappeared and though he has not had as good results in cancers of mesodermic and endodermic origin, he thinks that this is due to the preparation used, but advises giving them until more perfect preparations can be had.

THE PINEAL GLAND

This gland is a small reddish body and is placed beneath the back part of the corpus callosum, and rests upon the corpora quadrijemina. It contains a central cavity, lined with ciliated epithelium. The gland substance is divisible in an outer cortical layer, analogous in structure to the anterior lobe of the pituitary body, and an inner central layer, wholly nervous. The cortical layer consists of a number of closed follicles, containing cells of various shape, round, elongated, or stellate and fusiform cells. white and gray matter. The blood vessels are small and form a aggregated into small masses. The central substance consists of There is a gritty matter present, which consists of round particles very delicate capillary plexus.

The gland plays an important biological function up to the time of puberty. Tumor and injury to the gland during this

time cause over-growth, increased mental activity and early sexual maturity, and it is thought that the function of the gland is to retard a too rapid growth of mind and body during childhood.

A complete removal of the gland is difficult and clinical cases with autopsies, have been chiefly used to study the function of the gland. The glandular extract has been used to treat defective children with some success.

THE TESTICLES AND OVARIES

The interdependence and close relationship that exists between the testicles and ovaries and the other internal secretory organs has been repeatedly pointed out, and their great importance for the organism has been proven beyond all doubt. They have been considered since time immemorial the fundamental characteristics of the male and female, and all that is admirable in man and woman has been thought to depend on the genital organs. Objections have been raised by Pflüger and others to this generally accepted view. The problem of determination of sex for the higher developed animals remains unsolved, though it has been shown that in some of the lower animals, the unfertilized ova possess the character of the sex, and that certain insects have two kinds of spermatozoa, the one when entering the ova produces males, the other females. This is different among the bees. The queen is but once fertilized. She retains the semen in the receptaculum seminis and the ova entered by sperma cells develop queens and workers, whereas the unfertilized eggs develop males—drones. The human embryo is up to the beginning of the fifth week without gender, when the first differentiation commences and at the present it is unknown why at one time testicles and at another time ovaries develop and occasionally both in the same individual—true hermaphroditism.

The differentiation of the rest of the internal genital apparatus and the external genitals does not commence before the end of the third month of the embryo. Up to that time their growth is common to both sexes and rudiments of either remain, explaining the pseudohermaphroditism in individuals having both genders, with the exception of testicles and ovaries, partially or completely developed. The development of the sexual character of the genital apparatus is dependent on testicles and ovaries, though exceptions are observed to this rule. The male and female genital apparatus are considered the primary signs of sex, the secondary are those that have nothing to do with the process

of generation. The fundamental differentiation rests upon the cells of generation of body cells, (soma cells), the cells of male and female united have the faculty to produce a new individual. The soma cells exist indepently, divide and die. Considering the characteristic difference that exist between the male and the female in the skeleton, the fat distribution, the hair growth, the brain and the psychic qualities, etc., the question has been raised whether the body cells are male and female before the appearance of testicles and ovaries, or whether they become so in the course of development of the individual under the influence of the function of these organs. To prove the first theory, it has been argued that certain features of the male and female are characteristic at birth, for instance—the pelvis, the small hands and feet, etc. However, it must be remembered that the function of ovaries and testicles commences during intrauterine life of the foetus and Gehling finds the female pelvis only developed after the fifth month of embryonal life.

Pseudohermaphrodites possess body characteristics not corresponding to the testicles or ovaries they may possess, and those individuals that resemble men physically and mentally, with a female genital apparatus and others that resemble women with a male genital apparatus, female men and male women, have been cited to support the theory of the development of the body cells independent of the function of ovaries and testicles.

However, Neugebaur considers pseudohermaphroditism as a part of a general anomaly and Biedl suggests that the deficiently marked gender might be due to an insufficient differentiation of the cells of generation. The same author thinks that the heterogenous sexual character may be readily explained with true hermaphroditism, based upon the fact that ovaries and testicles are originally indifferent—bisexual. True hermaphroditism in nien is known and is frequent in animals. Tourneux has shown that every female mole possesses with a functioning ovary a rudimentary testicle. In cases of true hermaphroditism, both organs function, that is, they produce internal secretions influencing the development of the soma cells, the one more, the other less. The cause of change of the physical and psychic characteristics of an individual of one sex into those of another, occuring after puberty, are not rare, and can only be explained when the original bisexual character of testicles and ovaries and the dependence of the development of the characteristic features of the sex on their internal secretion is accepted. Correspondingly, whether the one

or the other gets the upperhand, they will be male or female.

Biedl quotes the case reported by Friedrich and Grawitz: "A well developed girl twenty years of age, with full breasts, marked female habitus, regular menstruation, gradually changes into a masculine type. The menstruations ceased with the loss of fat, hair commence to grow over the whole body. The formerly well developed breasts softened and shrunk, the hair of the head became short, the voice deepened, and a thick moustache and whiskers commenced to grow. She died three years later, after an ovariectomy for tumor." Quite a number of similar cases have now been recorded. The cases of partial change often observed during the menopause, deepening of the voice and the growth of hair on the face, further prove the original bisexual character of testicles and ovaries. Changes of the male to the female type and vice versa independent of the genital organs or born with hermaphroditism are observed in animals. It may be accepted as proven that the secondary signs of gender depend upon the testicles and ovaries and develop under the influence of their function. This is well demonstrated by the marked changes that take place in animals during the periods of heat and that disappear with it. These changes take place in men during the time of puberty. With the maturity of the genital organs, greater size in the testicles, and the change of voice in the male take place; the beginning of the menstruation and the development of the breasts and pelvis in the female; rapid growth of the skeleton and growth of hair around the pubis and in the axillae; the development of the nervous reflex mechanism necessary for coition and psychic changes, the sexual impulse—all are well marked and depend on the maturity of testicle and ovary and their function. A large number of cases of "pubertas precox" have been described. Some are due to the influence of internal secretions of other secretory glands, especially the suprarenals and the hypophysis, usually tumor growth in these organs, some to pure hypergenitalism. An interesting case of this character has been described by Sacchi. A boy, perfectly normal, developed gradually the signs of puberty at the age of nine years. He was 143 c. m. high and weighed forty-four pounds, with full muscular development. He had grown a long black beard, a full growth of hair covered the pubis, chest and legs. The psychic changes corresponded to the physical changes. After the removal of an alveolar carcinoma of the left testicle, retrogressive changes commenced and the patient gradually returned physically and mentally to the normal. This case

leaves no doubt that development and growth were solely due to stimulation of the internal secretion of the testicle.

One of the most characteristic secondary signs of the female are the mammary glands, present in both sexes. They develop only under the influence of the secretions of the maturing ovary at the time of puberty, and swelling of the glands during menstruation is due to the influence of the ovarian secretions. They commence to develop rapidly after fertilization of the ovum, stimulated by a substance produced by the growing foetus and they commence to function at birth when this ceases. That the development of the mammae during pregnancy is actually due to such a hormone produced by the foetus has been experimentally proven on animals by Biedl and others. They succeeded in causing development of the mammary glands in rabbits after intraperitoneal injections of embryonal extracts and intraperitoneal grafting in rabbits. Injections of placenta extract, or grafting of pieces of the placenta failed to cause such development.

Castration is frequently practiced in men and animals, usually before the time of puberty; in man, according to the Oriental custom, to produce "Eunuchs", custodians of the Harem and in animals for the purpose of fattening. Prostate gland and seminal vesicles atrophy after the operation and on that account castration has been introduced and successfully practised to cure prostate hypertrophy. The disease is caused by an excessive production of the stimulating hormone, coupled with a diminished excretion of the external seminal secretion.

The male sexual organs remain small if the operation is performed before puberty has commenced, and the individuals preserve an infantile character, though a greater accumulation of fat gives them occasionally a resemblance to the female, they never develop any characteristic signs of the opposite sex. The voice remains the soprano of a child and hair growth scarce. The same is observed in animals after castration—a conversion into the opposite sexual type never occurs. The consequence of castration of the female is the same as of the male, that is, the genital apparatus does not develop if the operation is performed before puberty. Grafting of the excised ovaries under the skin in animals causes their development and proves that this is due to the action of the ovarian secretion. The operation is frequent after puberty and causes the changes of the menopause, cessation of menstruation and atrophy of the genital apparatus. The

administration of ovarian extract diminishes and prevents in some instances the excessive accumulation of fat.

Menstruation occurs simultaneously with ovulation, the maturity and throwing off of an ovum. According to Pflüger it is caused by the production of substances in the growing ovum, producing hyperemia, tearing of the follicles and menstruation. Reimplantation and transplantation of ovaries has the same effect to keep up the menstruation. The ovarian secretion causes development and function of the genital organs and acts upon distant organs by way of the blood. This is proven by physical and psychic changes after castration, favorably influenced by the administration of ovarian extract.

Besides the specific influence, which the active principles of testicular and ovarian secretions exert upon the development of the sexual character, they possess others that influence the whole habitus of the individual. Maturing of testicles and ovaries is accompanied by physical and psychic changes and active juvenile vigor is its consequence. The physiologic diminution of their functions with advancing years is accompanied by the changes of age. Hair turns gray, teeth decay and drop out, fat is accumulated and muscles weaken. Castration and presenility cause similar changes. It shows that the function of testicles and ovaries is at least partially the cause of these changes. The influence of the function of testicles and ovaries upon the growth of the skeleton is well settled in animals and men. The long bones, especially the legs, grow long and the trunk remains short after castration and the same disproportion is found in hypofunction of these organs. The short legs of Southern races, of *pubertas praecox* and of some women, has been explained with early maturity of the genital organs. Animals, characterized by early maturity usually have short legs. Levy has succeeded in preventing these peculiar features of bony growth in capons by feeding them with testicular extract, and various other investigators have confirmed and extended these observations. The close relation of the organs of generation, the thyroid, the thymus and the hypophysis, all of which influence growth, acting in unison or in opposition, is well established. The powerful influence upon general metabolism of the substances secreted by the organs is also well known and that castration is usually followed by accumulation of fat in males and females has been mentioned. The favored places of deposition are the breasts, the hips, nates and the abdomen. The hypofunction of ovaries and testicles has the same effect of fat accumula-

tion in pregnancy, and during the menopause in women, and after middle age in men. This is probably partly due to the changed habits of the individual and partly due to decreased combustion, which may be increased by injection or feeding of testicular and ovarian extract.

Nitrogen metabolism is not influenced and the results of experiments as to the influence of testicular and ovarian extracts upon salt metabolism, especially that of calcium and phosphorus elimination, are at variance. The theory that osteomalacia is due to a disease of testicles and ovaries has not been proven, and the same is true of the origin of chlorosis, which disease has been thought due to an affection of the ovaries since time immemorial.

Though the existence of a close relationship between the testicles and ovaries and other internal secretory organs has been long known, the research to settle whether these organs possess an internal secretion is only of recent date. "The epithelium of the seminiferous tubules contains three varieties of cells, an outer layer lying in close relationship with the basement membrane of the tubules, an intermediate layer of the spermatogenic cells derived from the first layer of the cells and an innermost layer derived from the spermatoblasts of the second layer; the spermatoblasts, give rise to spermatozoa after having first become closely connected with special members of the outer layer of cells known as "Sustentacular cells." The interstitial connective tissue is loose, and contains numerous lymphatic clefts. Lying in it and accompanying the blood vessels are strands of polyhedral epithelial cells, of a yellowish color—"the interstitial cells of Leydig". Numerous and carefully conducted investigations have shown that these cells produce specific substances that enter the circulation, and cause the normal development of the genital apparatus, the characteristic morphologic and biologic features of the male.

The ovaries contain cells closely resembling the interstitial cells of the testicles. However, proof has not been brought as yet that the development of the female characteristics depend on the function of these cells;—on the contrary, it seems that these specific products solely influence menstruation and that the development of the female sexual signs depend on specific substances produced by the Graafian follicles.

Individuals are male or female by their testicles or ovaries and their characteristics depend on development and functioning of these organs.

Ever since Brown Sequard made his celebrated experiment on himself with testicular extract, this product has been employed in a number of affections. It has been used in age, impotency, neurasthenia, and in tabes dorsalis, psoriasis and many other conditions. The results have been disappointing, and it is now thought that it is the phosphor, which the extract contains that influences these diseases favorably.

Far better results have been obtained with preparations made from the ovaries; in fact, they resemble closely the thyroid medication in their effect. Whenever the ovaries are deficient in function or entirely absent, as is the case after operation and during the menopause, causing obesity, nervous symptoms, anginal attacks and various psychoses, these preparations furnish a substitute that relieves and cures in many instances.

Chlorosis has been treated with advantage with ovarian extract, and it has been shown that its administration improves the composition of the blood and increases the number of red cells.

The treatment of exophthalmic goiter with ovarian extract differs according to various observers. Some have had good results while others report that these preparations have no effect upon the course of the disease. This depends probably on the condition of the ovaries of the patient. The paroxysms of epilepsy associated with menstruation are said to be favorably influenced by such a treatment.

The specific substances, the active principles of testicular juice and ovarian extract, have not been isolated. Poehl has isolated a substance derived especially from nucleo albumin and contained in preparations produced from testicles and ovaries, which he calls spermin. Its chemical formula is $C_5 H_{12} N_2$. It is a leucomaine, colorless and tasteless, of syrupy consistency, alkaline in reaction and forms soluble salts with the mineral acids. It is an oxygen carrier and its oxydizing power is very great. It only acts in alkaline media. It has been recommended by Poehl as a general tonic; it restores the alkalinity of the blood. He thinks that it acts as a catalytic ferment regulating tissue oxidation. Favorable results have been obtained with it in a large number of diseases. In gout, uraemic attacks, diabetes mellitus, tabes dorsalis, in various acute infectious diseases, diphtheria, typhoid fever and cholera, syphilis, tuberculosis and in the diseases of the skin, eczema, psoriasis, etc., it has proved beneficial. It may be administered by mouth in a warm alkaline mineral water, before eating or by hypodermic injection, when quicker results are desired.

The internal secretions of other parts of the genital apparatus, have only been studied during the last few years. Fuerbinger, Pares and others conclude from their experiments on animals that the prostate belongs to the internal secretory organs. They found that after prostatectomy in dogs, the ejaculations cease, spermatogenesis stops temporarily and the testicles atrophy. With glycerin extract of the prostate they were able to prevent these post-operative consequences.

Administration of prostate preparation in man affected with disease of this organ have so far not given any results.

The internal secretions of the placenta plays an important role in the modern theories of eclampsia, based upon animal experiments, which prove the toxicity of placental extract. Brouchaecourt recommends placental extract as a galactagogue, and favorable results have been obtained by feeding fresh placenta of sheep in metritis and subinvolution of the uterus.

KIDNEYS

Brown Sequard claimed in 1869 that uremia is not solely due to retention of toxins in the blood, but largely to a deficiency of the internal secretions of the kidneys. He based his opinion upon cases of almost complete albuminuria with but few uremic symptoms and upon animal experiments. Animals live longer after ligation of both ureters than after double nephrectomy, though in both cases the retention of waste matter in the blood is complete and guinea pigs treated with injection of kidney extract after the operation survive longer than those not injected. Lepine found that injection of kidney extract causes rise of temperature and dyspnoea.

Bradford in 1899 showed that after the extirpation of a portion of parenchymatous tissue of the kidney, the excretion of urine increases to from two to five times in excess of the daily quantity and with this characteristic he observed an increase of nitrogen elimination. These observations have been confirmed by various investigators. According to Meyer, a pupil of Brown Sequard, uremic symptoms and Cheyne-Stokes breathing of nephrectomized dogs, can be partly and entirely removed by injections of glycerine extract of kidneys into the peritoneal cavity or by injections of defibrinated blood derived from a normal animal. Ayello and Parascandelo prolonged the life of nephrectomized animals by injecting glycerine extract of kidneys, and found that the albuminuria following the extirpation of one kidney did

not occur after such treatment with glycerine extract and Tigerstedt and Bergman showed that the cold watery extract of the kidneys, contains a substance that causes rise of blood pressure when intravenously injected. They called it Renin. The substance exists especially in the cortical portion of the kidney, is soluble in water, diluted hydrochloric acid and glycerin and insoluble in 50% alcohol and is destroyed by boiling. However, substances that raise blood pressure can be extracted from other organs and are no proof of internal specific secretions.

A number of favorable reports have been published of patients suffering from kidney disease, treated with preparations obtained from the kidneys, or with fresh kidney substance. Production of diuresis, diminution of albumin and amelioration of uremic symptoms followed. However, a large number of observers have obtained none or unfavorable results.

So far the question whether the kidneys have an internal secretion has not been settled and the favorable results reported from the treatment with renal preparations in nephritis, may be due to their diuretic and stimulating effect upon parenchymatous tissue left intact.

THE PANCREAS

Von Märing and Minkowski discovered in 1889 that an extirpation of the pancreas, besides causing serious digestive disturbances, was invariably followed by an elimination of sugar in the urine, the consequence of a hyperglycaemia. It was further found that only a radical operation would have this serious sequel, and that one-third and even less of pancreatic tissue left would prevent sugar from appearing in the urine, or only cause a light glycosuria. Minkowski and Hedon proved with animal experiments that the pancreas diabetes is not due to injury or destruction of vascular and nerve tissue, nor to a deficiency or absence of the external pancreatic secretion. The operation when performed on dogs causes hyperglycaemia, elimination of sugar, formation of aceton and acedosis, polydipsia, polyuria and polyphagia, emaciation and coma. Degeneration and atrophy of the pancreatic tissue left after partial extirpation of this organ, will convert a light form of glycosuria into a severe diabetes. In the latter, sugar elimination continues with an exclusive meat diet. Increased feeding increases sugar elimination and the various carbohydrates, starch, cane sugar and fruit sugar are completely eliminated as glucose, whereas a considerable portion of laevulose is used and stored away as glycogen in liver and muscles.

A toxic nephritis in a dog with extirpated pancreas will reduce sugar elimination, and it is often observed in man effected with diabetes that sugar elimination will cease with the appearance of albumin and casts in the urine. This phenomenon has been explained by a greater density of the kidney filter against sugar in nephritis. Hyperglycaemia is the common cause of every form of diabetes, with the exception of the renal form, which is caused by toxins acting upon the kidney cells. Sugar passes through the kidneys and is eliminated with the urine and when the normal amount contained in the blood rises above 0.1%, glycogen disappears rapidly from the liver and is diminished in the muscles. Hyperglycaemia and sugar elimination in severe forms of diabetes, after the use of glycogen deposits and elimination of carbohydrates contained in the food, is due to proteids and fats, which also are the source of the acedosis that leads to coma. An incomplete combustion of carbohydrates in the organism is considered the cause of the hyperglycaemia, though it has been shown that oxydation is increased, which explains, with elimination of the carbohydrates as sugar, the rapid emaciation.

The cause of pancreas diabetes has not been fully explained. Von Märing and Minkowski concluded from their experiments that it is due to the deficiency and absence of substances produced by the internal secretion of the pancreas, which they thought was necessary to sugar combustion, and this is the view accepted by most investigators today. The theory of those that believed pancreas diabetes is due to nerve lesions caused by operation, and the views of others that claim the cause to be due to auto-intoxication after the removal of the pancreas, has been disproven. The negative results obtained by the administration of pancreas preparations in diabetes has been advanced as an argument against this theory.

The amount of sugar in the blood depends on its production in the liver, which organ converts carbohydrates into glycogen deposits it for future use and re-converts it into grapesugar. In this form it is carried by way of the blood to the tissues and organs of the body. A part of it is used immediately for the production of energy. The surplus is deposited, especially in the muscles, as glycogen.

Most investigators believe at the present, that the hormone of the pancreas exerts an inhibiting effect upon the nervous apparatus, which regulates sugar production in the liver and that with the deficiency or absence of the internal secretion of the pancreas,

an over-production of liver sugar takes place, causing hyperglycaemia. Adrenalin acts antagonistically to it, and increases the amount of sugar in the blood by stimulating the same nervous apparatus. The internal secretion of the thyroid has a similar antagonistic effect to the hormone of the pancreas, whereas that of the parathyroid acts in an inhibiting manner upon sugar production in the liver. The hormone of the pancreas has so far not been isolated, nor are the opinions as to the place of its production uniform. Laguess advanced in 1893 the theory that the cells of the islands of Langerhaus produced the internal secretion, the acini, the external secretion of the pancreas, the one continuously changing into the other, and vice versa. He based his conclusions upon intermediate forms, which he found and which he and others after him could produce experimentally by injecting pilocarpine, or phloridicine, or by overfeeding or starving the animals. The islands of Langerhaus consist of irregular groups of polygonal cells scattered about in the glandular tissue. The cells have round nuclei and contain a few small granules. They are well supplied with capillaries.

Lombroso advanced the theory that the islands of Langerhaus and the acini are together the source of the internal secretion; or rather, that each produces both secretions, the external and the internal. He also claimed that the internal secretion of the pancreas is important for the function of the intestinal mucous membrane to absorb nutrient material. His experiments have been confirmed by Zunz, Mayer and Fleckseder. The treatment with pancreatic preparations has been well established and hardly needs mentioning. It is used in disorders of the alimentary tract and aids in the treatment of intestinal catarrhs. It is useful in constipation and diarrhoeas. I treated successfully with pancreon, a patient sixty-eight years old, who had arteriosclerosis and all the troubles that go with it, and who had suffered for years with chronic diarrhoea. Nothing else would stop the diarrhoea and it would commence again as soon as he interrupted the treatment. The success of the treatment of diabetes mellitus with pancreatic preparations has been very varying in the hands of numerous observers, and though some report cures, the deductions of others—and that is by far the larger number—are disappointing.

THE LIVER

The liver is the largest gland in the body and provides external and probably internal secretions to the organism. Bile

passes through the hepatic duct into the intestines, increased during digestion and through the cystic duct into the gall bladder during the intervals, where it is stored up until needed. It is a product of the liver cells, not absolutely essential to life. This is proven by a fistula through which all the bile formed may be removed without impairing health seriously. Bile carries off waste products, the results of catabolic processes.

Probably one of the most important functions of the liver is to form glycogen, store it up and pass it into the blood, as required by the body. The most favorable treatment to produce it, is a mixed diet, consisting of carbohydrates and some proteids. Fat is not converted into glycogen. The final changes of antecedent substances of proteid metabolism into urea take place in the liver. This has been proven beyond a doubt. The removal of the liver in frogs stops urea formation and "Ecks' fistula" established in dogs, a direct connection between the portal vein and the inferior vena cava—excluding the organ largely, lessens the amount of urea. Mammals die after the extirpation of the liver. Diseases that cause degeneration of liver tissue—cirrhosis, etc.,—lessen the amount of urea. Ammoniac is formed instead. Besides, autolytic ferments are found, which explain the disintegration of the organ when kept free from bacteria.

Extract of liver injected into animals has not given any specific results; it lowers blood pressure, just like extracts obtained from other organs and tissues, and the course of liver cirrhosis is not influenced, according to most observers, by the treatment with liver extract, though a few favorable reports are on record.

Schiassi claims good results with the administration of liver extract and bone marrow in a case of Banti's disease, after the removal of the spleen.

Liver extract has been used in some cases with advantage in purpura, haemophylia, haematemesis, metrorrhagia, etc. According to Gilbert and Carnot the liver cells produce a substance which prevents blood extravasation. Little is so far known of the internal secretion of the liver.

STOMACH AND INTESTINES

The treatment with secretions of the stomach is constantly employed in the diseases of the digestive tract and does not need further discussion. Pancreas secretion is depending on the contents of the duodenum and reaches its maximum after the chyme

has passed into the bowel. This was first observed by Claude Bernard and explained by Pavlow as a simple reflex act. Impulses travel from the stimulated mucous membrane to a center in the medulla along vagus fibres and motor impulses from the same source along vagus or splanchnicus fibres to the pancreas. Bayline and Starling, who after severing an intestinal coil from all its nervous connections, could cause pancreas secretion by bringing hydrochloric acid into its lumen, and not being able to produce the same effect by intravenous injection of hydrochloric acid, concluded that the secretion of the pancreas is due to an intestinal hormone, which reaches the pancreas by way of the blood.

The treatment of the upper portion of the intestine with the hydrochloric acid yielded a substance, not a ferment, they called secretin, which when intravenously injected, acts in a stimulating way upon the pancreas. According to their views, secretin is derived from prosecretin, present in the cells of the mucous membrane of the duodenum. These observations have been confirmed by a number of investigators. The most widely accepted view is at present, that pancreas secretion is due to a reflex act, as explained by Pavlow, and to the action of secretin, which acts in correlation with the nervous system—Trypsogen—enters the bowel through the pancreatic duct and is there converted into trypsin by coming in contact with the ferment enterokinase.

According to Deleznac and Trowsin, secretin produced under the influence of the acid chyme entering the duodenum, regulates bile, pancreatic and intestinal secretion. Secretin produced by the intestinal mucous membrane and probably stored away in the spleen, from which organ it can be extracted in large quantities, produces an active intestinal peristalsis when introduced into the organism by intravenous or intramuscular injections. This hormone has been proven to be an effective remedy in the treatment of chronic constipation and intestinal paresis in a large number of cases, though in some it has failed.

If it acts, its effects are enduring, and evacuations occur daily. It seems that it acts in a stimulating manner upon the intestinal glands and causes production of secretin, which in chronic constipation is absent. I have used it recently in a case of an almost moribund patient, a woman sixty-five years of age, who had suffered a lifetime from chronic constipation and who submitted to an operation in Europe to relieve an acute paralysis of the bowels. An artificial anus in the left iliac fossa was made, giving temporary relief. The operating surgeon thought that the

condition was due to carcinoma. Returning to this country, an exploratory laparotomy was performed and the entire intestinal tract found free from malignant growth. The opening was closed and the paralysis of the bowels returned. I then saw her for the first time and injected 15 CC of Hormonal "secretin" into the buttocks. Three days after the injection she had two large semi-liquid stools and daily evacuations followed. She subsequently died of general sepsis from a streptococcus infection of the left knee.

The secretions of the stomach are due to nervous reflex acts, aided by hormones. Edkins has shown that extract produced from the mucous membrane of the pylorus with hydrochloric acid, intravenously injected in small and repeated doses causes secretions of gastric juice, and Pavlov, that gastric juice is secreted after the vagi have been separated, when food enters the stomach.

INTERNAL SECRETIONS OF THE SPLEEN

Extracts of the spleen do not exert any specific action, whether intravenously or subcutaneously injected into animals. Hedin has shown that the spleen and also the kidneys and liver, contain proteolytic enzymes and Flexner, that definite irritative hyperplasia can be developed by the injection of the preparations of the spleen into animals. Splenic substance has been used in the treatment of anemia, chlorosis, malaria, Basedow's disease and leucocythemia. Landau and Hirsh have isolated a substance which they call stagnan by autolysis of splenic substance. It increases the coagulation of the blood and stops capillary hemorrhages.

Dohrn, Merxer and Suelzer discovered in 1910 a peristaltic hormone in large quantities in the spleen, which was found to be identical with secretin elaborated in the intestines. This substance, as mentioned before, has been introduced into practice under the name of "hormonal" and has been used successfully in a large number of cases to relieve chronic constipation. Suelzer reports, out of twenty-one grave cases, fifteen successfully relieved; one injection of 15 CC was followed by regular daily evacuations. The effect is usually noticed after the second or third day. He believes that this hormone produced in the intestines is probably stored away in the spleen. When injected intramuscularly or intravenously it stimulates the intestines to their normal production, probably acting by intervention of the nervous system to procure the evacuations.

No undesirable effects have been so far reported from the use of it. The injection is slightly painful. It has been very successfully used in post-operative treatment and in acute paresis of the bowels though it has failed in about 20% of the cases treated. It occasionally causes a rise in temperature and some pain. Most observers recommend the intravenous injection. I have previously mentioned the case treated by me with this method.

THE BONE MARROW

The bone marrow is chiefly the seat of production of white and red cells, which it constantly passes into the blood current and though it has not been proven by experiments in men and animals that it passes a specific internal secretion, its administration in various diseases of the blood has given favorable results. If the number of red cells and the haemoglobin are below normal, treatment with bone marrow will cause improvement. It has been used with varying success in secondary and pernicious anemia, chlorosis, rickets, leucaemia, in wasting disease, etc.

The extract of raw meat has been used especially in tuberculosis and some investigators speak very favorably of its effect in this disease, though others are less enthusiastic. Chalmers and Watkins found enlargement of the thyroid and parathyroid bodies in fowl after feeding with lean raw meat, which seems to prove that raw meat juice exerts a specific action. Boiled juice is of no therapeutic value.

A large number of experiments have been made with the extract of nerve tissue. Wassermann and Takaki showed that tetanus toxin could be neutralized with the extract of nerve tissue.

One cubic centimeter of an emulsion of brain tissue, prepared from the brains of various animals susceptible to the disease and mixed with ten fatal doses of tetanus toxin, injected did not produce tetanus in the animals. It seems from further observations that the two substances must be mixed before injection to prevent the disease, though Krokiewicz reports three cases treated with repeated injections of 5.0 grammes of fresh brain substance and 15 CC of normal salt solution. The treatment was commenced on the ninth day of the disease and the patient cured on the nineteenth day. Babes claims that hydrophobia produced in dogs by injection of virus from rabies can be successfully antagonized with injections of the extract of the medulla of sheep, and a number of nervous diseases, epilepsy, eclampsia, chorea affections, have been treated with this extract, or with the cerebrin of

Poehl. Shaw gives the advice that if the nitrate of silver treatment, the potassium bromide treatment, atropine treatment, the valerian treatment, and the borax treatment have failed to cure epilepsy, organotherapy should be tried.

The effect of the treatment with hormones, chemical substances produced by certain cells or cell groups and conducted by means of the bloodstream to the cell complexes, which they stimulate to specific function, assimilatoric or disassimilatoric, inhibiting or increasing function, is clear. They substitute substances that are normally present in the blood and act as chemical messengers, carried by the blood, upon distant parts of the body. The aim of organotherapy is to return an abnormal blood, deficient in hormones, or containing them in excess, to the normal and with it alter blood composition, influence blood distribution and organ activities. "Extracts of an organ exert on the same organ an exciting influence which lasts for a longer or shorter time—when the organ is insufficient it is conceivable that this augments its action and, when it is injured, that it favors its restoration." This is known as Hollians Law.

CHAPTER XII

CHEMOTHERAPY

TREATMENT WITH DRUGS

The treatment with chemical compounds—"drugs"—fills the most prominent place in the armamentarium of the physician, since time immemorial. No miracles can be performed with this method. As with other therapeutic methods, we can alter the composition of the blood and influence its distribution, and increase or decrease organic function. This, however, can be done at a moment's notice. A failing heart can be steadied and a flagging respiration stimulated, the digestive organs toned, appetite and sleep restored, a clogged-up colon emptied and diuresis increased, hemorrhages can be stopped, anemic organs can be filled with blood and congestion relieved. We can slow or increase the velocity of the blood current, influence metabolism, lower temperature, calm delirium, lessen or stop pain, increase the resisting power of the body, neutralize toxins, destroy bacteria and influence the function of every organ in the body. The instantaneous or the slow and prolonged effect that can be produced with it, is of enormous advantage, though it has its drawbacks. With drugs, we introduce some foreign substances into the blood, usually of high toxicity. It has been correctly said that drugs act like a sword with two edges, they act for good or for evil; they benefit or do harm. A correct diagnosis and a thorough knowledge of their action in health and disease is necessary to obtain results and to prevent damage. If administered for any length of time, the cells of the body become accustomed to live in the body fluids that contain them, and sooner or later, doses have to be increased and the treatment has to be entirely changed or employed intermittently to be effective. It must be combined in all cases with the physiologic methods to obtain permanent results; when these fail there is no hope of recovery—people cannot live forever on drugs.

The action of drugs is similar to that of the protective substances produced by the cells of the organism in health and disease. The alkaloids and other active principles of plants introduced into the blood by mouth or by subcutaneous, intramuscular

or intravenous injection, act like the hormones—as chemical messengers. Circulating in the blood, they affect distant parts, stimulate or diminish function or inhibit it altogether. They act in minute quantities by way of the nervous system or independently in correlation with it. The mineral salts act similarly to the active principles of plants by ionization and also by osmosis “salt action”. The antiseptics have to be employed in larger quantities, the blood has to be saturated with them; they act similarly to the immune sera, antitoxic and bactericidal, and the proteids, fats and some of the mineral salts act as foods.

Sharp division lines cannot be drawn. A large number of drugs perform various functions at the same time. Their action has been studied by animal experiments, on the healthy organism of man and by clinical observation. Their number is so vast, that only a few can be discussed in a book of this character.

The active principles of plants, mainly alkaloids and glucosoids, form one of the most important chapters of Chemotherapy.

The first knowledge of their existence was derived from Serturmer's discovery of morphine, one of the alkaloids of Opium, in 1806, followed soon by many others, so that at the present they are known to exist in every plant. This important discovery has been the basis of scientific research of the action of drugs. It enables the physician to give a definite quantity of these active principles by hypodermic injection, and to study their effect on animals and man in health and disease.

Alkaloids are nitrogenous crystalline substances derived from plants. They form salts with acids usually soluble in water, in which they are most frequently employed on that account.

Glucosoids are active principles of plants that can be broken up by the action of a mineral acid into sugar and another radical.

Resins, also of vegetable origin, are mixtures of various substances, usually not soluble in water, but freely in alcohol; ether and chloroform, and oleoresins are mixtures of resins with a volatile oil. Volatile oils are active principles of plants freely soluble in alcohol and ether, but only sparingly in water. They do not form soaps with alkalis and may be completely evaporated without leaving a residue. All possess a strong aromatic odor. A number of acids and mineral salts exert a similar action upon the organism, as do the proximate principles of plants.

The dosage is of the highest importance and though a minimum and a maximum dose are found for every drug in every book on *Materia Medica* for the adult and child, these data are

only of limited value. Age, sex, constitution, general health, the stage of the disease, the time of the day when given, idiosyncrasies of the individual, mode of administration, etc., all influence their effect, and it is, therefore, best to ascertain the dose necessary in each case and for each individual by administering the drug in a small quantity at short intervals until the average dose is ascertained to produce a desired effect or until the first toxic symptoms appear. The active principles are admirably suited for this purpose and should be preferred, unless for important reasons the galenic preparations are indicated. The general treatment with the active principles has been introduced by Burggraave and his pupils, and it is now used in many countries. These substances are accurate in dosage, dissolve rapidly in the stomach and can be given by hypodermic injections; they are easy to take by mouth, and produce the desired effect with safety. They act upon the nervous system, central or peripheral, direct or by reflex, they stimulate or depress, produce tension or relaxation, spasms and convulsions, or paresis and complete paralysis of muscles, and increase or decrease organ and glandular activity, secretion and excretion. They influence the distribution and composition of the blood upon which finally all therapeutic results depend. The blood current carries them where needed and assimilation, elimination and repair follow. Their elimination may be carried on by one or several channels, the kidneys, the glands of the intestines, the lungs and the skin.

Some drugs act only by coming in contact with the diseased tissue of the body as a protection, or by dissolving morbid material. The mucelagenous substances, the astringent and caustics belong to this class. Others act by correcting the results of disordered function. Hyperacidity of the gastric juice is corrected by administering alkaline carbonates and acidity of the urine and the stools is relieved in like manner. The active principles of plants and the mineral salts that resemble them in their action are by far the most important in the treatment of disease. How they act is not fully understood, though it is at present generally accepted that they form a union with some of the ingredients of the cells of the organism, producing by chemical action physiologic effects. Usually this union represents a very loose compound, though in some instances it may be so firm as to make a separation of alkaloid and tissue difficult.

Most of the drugs employed possess an affinity for certain cells of the body, for instance—they will only unite with the proto-

plasma of the cells of the central nervous system or those of the terminal endings of certain peripheral nerves. This is known as the selective action of drugs. A few, termed general protoplasmic poisons, will combine with almost any of the tissues of the body. The union of an alkaloid with the cell protoplasm changes the reaction of the cell to the physiologic stimuli—it alters its function or inhibits it entirely. Nerve cells receive and convey sensory impulses to centers, deposit them and convey motor impulses.

Anorganic Salts possess when in solution, specific chemical action, due to the ions in which they divide.

Solutions of common table salt and sugar form clear liquids that differ considerably in their physical properties, though prepared to contain an equal number of molecules in the same volume. The salt solution exerts higher osmotic pressure and possesses a lower freezing point and higher boiling point, than the solution of sugar; it acts as if it had a larger number of molecules in the same volume and is a conductor of electricity, whereas the solution of sugar is a non-conductor. It is thought that this difference in physical properties of the two solutions is due to the splitting of the sodium chloride into its constituent parts, Sodium and Chlorine Ions, and that the salt solution contains these electro-positive Sodium (Na) and electro-negative Chlorine (Cl) "Ions" beside Sodium chloride molecules, the ions acting as molecules. This explains satisfactorily the higher osmotic pressure, the lower freezing point and higher boiling point of the salt solution. This process has been called dissociation or ionization, and the substances that dissociate when dissolved, and form ions, are called electrolytes. Dissociation increases with dilution, so that when highly diluted, the salt solution consists almost solely of Sodium and Chlorine Ions.

All salt solutions, acid and bases, conduct electricity, dissociate and form Ions. The salt solutions split up in positive metal Ions and negative acid Ions, the acids in positive Hydrogen (H) and negative acid Ions, the bases in positive metal and negative Hydroxyl (O H) Ions. Not the molecules but their constituent parts, the Ions, produce the reaction in every chemical process. Ionic action is the basis of analytical chemistry. Dissociation, that is Ionization must not be confounded with chemical decomposition. Free chlorine or sodium cannot be detected in solution of sodium chloride. Silver chloride (Ag Cl) is insoluble in water and is formed by the action of any soluble Chloride,

for instance:—Sodium-Chloride (Na Cl) and Silver Nitrate (Ag No_3) in solution or $(\overset{+}{\text{K}} + \bar{\text{Cl}}) + (\overset{+}{\text{Ag}} + \bar{\text{No}}_3) = \text{Ag Cl} + (\text{K No}_3)$. This reaction takes place because the salts are dissociated and contain Silver and Chlorine as Iones in their solution.

Chlorate of Potash does not give this reaction with Silver Nitrate, because it is dissociated in positive potassium (K) and negative (Clo_3) Iones. Not alone chemical analysis, but the effect of many drugs depends upon this dissociation. The Hydroxyl group (OH) of Sodium, Potassium and Ammonium Hydroxide acts in a highly caustic manner upon animal tissue and loses this caustic property when combined in one organic molecule that does not dissociate, as for instance, in alcohol ($\text{C}_2 \text{H}_5 \text{O H}$) and though the Cyanides of Sodium and Potassium are deadly poisonous because their solutions dissociate into Potassium Sodium and Cyanogen Iones, Potassium Ferrocyanide is not poisonous because it splits up into $2\text{K} + (\text{Fe Cn}_6)$ and does not contain the poisonous Cyanogen Iones. For the same reason are the organic compounds of arsenic less poisonous than the anorganic compounds. The physiologic action of such a solution depends on the number of the Iones it contains or their concentration. If, for instance, Mercuric Chloride is mixed with a solution of Sodium Chloride the antiseptic action of the former is lessened, because the dissociation of the Sodium Chloride is thereby diminished.

The Ione that is most foreign to the organism is predominating in the physiologic action of dissociated anorganic salts. In Chloride of Potash, the Potassium Ione predominates because every cell of the body contains a large amount of Chlorine. Whereas, if Potassium Bromide is administered the Bromine action is the most prominent, and Sodium Salts act by their acid ions because sodium ions are present in large numbers in the organism.

The Salt Action of this class of chemical compounds differs entirely from their chemical action, it is determined by the law of osmosis and depends consequently on the number of molecules and ions contained in the solutions independent of their chemical nature.

If one end of a V-shaped glass tube is carefully filled with distilled water and the other with a solution of sodium chloride, so that the liquids do not mix, a process of diffusion commences at once at the contact zone of both—that is, water passes into the salt solution and salt into the water—till the liquid contains an equal number of molecules and Iones in each volume. When this point

is reached the solution in both ends of the tube is isotonic, that is, its osmotic pressure is the same in both. The same process takes place when water and salt solution are separated by a membrane that allows both liquids to pass with equal facility. The level of the liquid in the ends of the tube remains the same.

If, however, instead, a semipermeable membrane is selected which only allows the water to pass and not the salt, the water will pass into the salt solution and the level in the end of the tube that contains it will rise till the osmotic pressure, depending on concentration, number of molecules and Iones, prevents its further passage into the salt solution and at the same time prevents it from passing back. In other words, the osmotic pressure holds the water in the salt solution. If solutions of different osmotic pressure are separated by a semipermeable membrane, water will pass from the hypotonic into the hypertonic solution from the diluted into the concentrated, till both are isotonic. Hypertonic solutions draw water from hypotonic solutions. All animal membranes allow water to pass. Some of the salts pass them almost with the same facility, others less so, and some do not pass at all, that is, the membrane acts in these cases like a semipermeable membrane.

Animal and vegetable cells contain crystalloids, anorganic or organic salts and colloids, complicated chemical compounds, like albuminous substances. Crystalloids diffuse, that is, they pass membranes with more or less facility, colloids do not. The proportion between the two within the cells is of the greatest importance for their function. Even minor changes may produce serious disturbances, and cause death of the cell if they are considerable. Salt solutions introduced into the organism, not isotonic with the body fluids, produce such changes. Water passes from the cells and tissues of the body into the salt solutions and salt into the cells, if they are hypotonic, and vice versa, if they are hypertonic. If the yolk of an egg is placed in a concentrated salt solution, it shrinks, water passes from it into the salt solution but it swells and finally breaks if placed in distilled water, as the water passes with greater rapidity into the yolk than the salt does from it into the water. The cells of the living organism show a specific affinity to certain substances, they possess selective power that is so far not satisfactorily explained.

Certain salts and sugars, are rapidly absorbed by the epithelial cells of the intestinal mucous membrane, but do not pass into the red cells of the blood, and Sodium Sulphate is not absorbed by

the cells of the intestines, but passes with greater facility through vessel walls.

Water acts but little upon the human skin on account of the secretion of the sebaceous glands that saturates it, though it has been observed that in a bath of twenty-four hours duration, and more, edemas due to heart and kidney disease have disappeared without any increase in the quantity of urine. Salts contained in the water of the bath do not pass through the skin.

Hypotonic salt solutions, however, if long enough in contact with the tissues will produce swelling of its cells by passing water into them and withdrawing salts. Saltwater fish die in river water and vice versa, sweet water fish die in salt water. Wounds are irritated by hypo and hypertonic salt solutions, whereas neutral solutions do not cause pain. Concentrated solutions dry the tissues, living or dead, so much so that they prevent the growth of micro-organisms. The pickling of meat and the conservation of food by adding sugar depends upon this property.

The effect of the treatment of gastro-intestinal catarrhs at various watering places with mineral waters, poor in salts, depends upon the action of hypotonic salt solutions upon the mucous membranes. They cause swelling and destruction of the cells and their regeneration. Concentrated solutions irritate and cause nausea, vomiting, and inflammation of the gastro-intestinal mucous membrane. Common table salt is a necessary food and an agreeable condiment to promote the appetite. Muscles and nerves die rapidly in hypo and hypertonic salt solutions. The red blood corpuscles shrink in hypertonic solutions and swell in hypotonic solutions, but do not change in isotonic solutions. A 0.9% salt solution is usually termed a physiologic salt solution for mammalia. The osmotic pressure of the blood is constant and the ingestion of large quantities of liquid and solid food and the loss of water by vomiting, diarrhoea and hemorrhages, changes it but little. Even if hypotonic or hypertonic solutions are injected into a vein, this pressure is soon restored to the normal.

The action of capillaries and kidneys keeps the volume of the blood and its osmotic pressure constant. If the amount is increased by injection of fluids, hypotonic or isotonic salt solutions, it will return to the normal in a short time, often in a few minutes. Water will pass through the capillaries into the tissues to return again after diuresis has commenced, which soon becomes profuse. Even large amounts of isotonic salt solutions do not

change the osmotic pressure, they change the proportion of red cells and serum, but the passage of water and salts into the tissues soon restores the proper proportion of both. The salts return later, and are eliminated by way of the kidneys.

An injection of a hypertonic salt solution draws water from the tissues into the vessels, dries them, gives rise to the sensation of thirst and increases diuresis. Some of the salts pass by diffusion into the tissues to return later, in form of a diluted solution, into the vessels to be also gotten rid of by diuresis.

Water or a readily absorbed salt solution, no matter whether diluted or concentrated, increase diuresis. After ingestion of large quantities of water, the urine is pale in color and low in specific gravity and relatively poor in solid constituents, whereas the absolute amount of solids during the twenty-four hours is increased, because the water that passes into the tissues frees them from solid particles, washes them, and returns in form of a diluted salt solution into the vessels. The increase of the quantity of urea if the urine increases, with other solids, is probably due to the same washing process.

Potassium salts have a greater diuretic power than sodium salts and are, therefore, of special interest. Potassium carbonate gives with the sodium chloride of the organism potassium chloride and sodium carbonate. Both are useless to the system and in being excreted by the kidneys, act as diuretics. A vegetable diet, rich in potassium salts, increases, therefore, the demand for sodium chloride and a meat diet decreases it.

Animals that live on plants hunt the "salt licks." This is important to remember to satisfy the salt hunger, if patients are placed on a bland vegetable diet for therapeutic purposes.

THE ALKALOIDS, the active principles of plants are of great interest, and as mentioned, their action in the human organism resembles that of the hormones.

STRYCHNINE and the closely allied BRUCIN are two alkaloids derived from the seeds of *Nux Vomica*, a tree growing in the East Indies and Australia. Strychnine, like most of the alkaloids, is but little soluble in water, and, therefore, commonly used as sulphate or nitrate, it is rapidly absorbed, whether taken by mouth or hypodermic injection, and in a short time to a large extent at least, eliminated unchanged, though a small part remains and accumulates in the system, and is only slowly gotten rid of. Strychnine is white in color and of an intensely bitter

taste. It acts in a stimulating manner upon the centers of the medulla and spinal column and produces tetanic convulsions when given in toxic doses. In small doses it increases reflex excitability. Its action upon the vasomotor centers causes contraction of vessels and increased blood pressure and upon the respiratory center increased velocity and depth of the respiration. The heart's action is little influenced, though it may stimulate the vagus center and slow pulse. Corresponding to the reflex excitability of the spinal column, the acuteness of sensory impressions is greatly increased. The field of vision is enlarged, finer shades of light are readily distinguished and the acuteness of hearing, of smell and of touch is heightened. Large doses paralyze the end organs of the motor nerves. The first symptoms of intoxication are greatly increased reflexes and a tendency to tetanic contractions with stiffness and pain in the muscles, difficulty of swallowing, of breathing and fibrillary twitching in various groups of muscles. Tetanic convulsions, the sign of acute strychnine poison and death follow, not rarely during the first prolonged attack, due to asphyxia or general paralysis of the medullary centers. Consciousness remains clear and pain intense. Locally, strychnine acts like any of the bitter tonics and can be detected by its taste in a solution of 1:50,000.

It has an accumulative action and symptoms of acute poisoning may be produced by the administration of small doses for a long period of time. It is always safe to discontinue it from time to time and at once, when toxic symptoms appear, such as slight stiffness of the masseters and muscles of the neck, increased acuteness of the special senses and greatly increased reflex excitability.

Strychnine was formerly largely used in every case of paralysis. It has been abandoned, however, in cases where the paralysis is due to a lesion, as in apoplexy and polyomyelitis anterior. Stimulation is useless where there is destruction of tissue and may do great harm if used during the acute condition, though after this has past it may be tried to stimulate what is left. In paralysis due to intoxication, especially in lead paralysis, it is still highly recommended and in amblyopia with and without atrophy of the optic nerve it is frequently used by the specialist. As respiratory stimulant it is of the greatest value in the diseases of the lungs and in intoxications that depress the respiration like opium. It stimulates the hollow viscera, the stomach, intestines and bladder to greater activity and restores tone to

weakened sexual organs. Its effect upon the circulation is widely used in collapse, shock and in myocarditis, and must be given in rapidly increasing doses in these affections, up to 1-10 of a grain, to be discontinued at once when toxic symptoms appear. The permanent effect observed during this treatment is due to a better nutrition of the heart muscle, produced occasionally with this medication, when digitalis has failed. Strychnine is used in the treatment of chronic alcoholism. It counteracts the effect of alcohol upon the nervous system, improves appetite and digestion and lessens the morbid craving. Strychnine after it has entered in minute quantities into the blood stream, is carried by the current till it reaches the cells of the nervous system to which it has affinity. It passes through their membranes and, dissolved in the lipid tissue, exerts its influence. The sensitiveness of the cells is increased to physiological stimuli, and motor impulses of greater force are sent to muscles and organs. Organic function is improved and muscles are toned accompanied by better blood distribution and consequent nutrition. Aside from its direct action upon circulation and respiration, it stimulates locally by reflex the flow of saliva and of gastric juice.

CURARIN, another alkaloid of the genus *strychnos*, is used by the natives of the Orinoco Valley as arrow poison and is contained with two other alkaloids in a blackish-brown mass derived from the bark of the tree. It paralyzes the end organs of all motor-nerves that supply striated muscles and has no effect on the endings of any other kind of nerves when given in small doses. The muscles of the extremities are first paralyzed, followed by paralysis of those of head and trunk and lastly by those of respiration. Artificial respiration saves life. In large doses it paralyzes the vagus fibres and the muscular fibres of the vessels, causing blood pressure to drop.

Curarin shares its property to paralyze the end organs of the motor nerves with various other substances, for instance—methylstrychnine, methylveratrine and others. It is rapidly eliminated with the urine and can, therefore, be taken by mouth in comparatively large doses. It has been widely employed in physiologic and pharmacologic experiments, but is little used for therapeutic purposes, on account of the unreliability of the product on the market.

A few cases of tetanus and hydrophobia, diseases characterized by excessive irritability of the motor terminal nerves, have

been successfully treated with this remedy. In this group of alkaloids are also placed gelsemine, contained in gelsemium sempervirens and thebaine, an alkaloid of opium.

OPIUM is obtained from *papaver somniferum* or white poppy, a native plant of Asia. It is the dried milky juice of the unripe capsule of the plant and was known to the ancients, who used the poppy flowers as the symbol of sleep. It is a very complex substance and contains twenty known alkaloids, meconic and sulphuric acid and various other ingredients. The alkaloids, though differing, bear a certain relationship to each other, and are all characterized by producing narcosis and heightened reflex irritability.

LAUDANIN, when injected, causes tetanic convulsions and morphine narcosis. The other alkaloids pass gradually from one into the other. Morphine is the most important of the group. In small doses it produces sleep, resembling natural sleep, which becomes more and more deep when large doses are taken, and this is followed by coma and death when the dose has been excessive. Its effect upon animals varies with the species. In frogs narcosis is followed by tetanic convulsions, whereas in the highly developed animals its action resembles very closely that produced in man. All animals bear morphine well and have to take large doses to produce toxic effects. As a rule, the lower developed the animals, the larger has to be the dose. Morphine stops pain, even when given in minute quantity, consciousness remains clear, sensory impressions are more acute and mental labor can be performed with ease. Rapid flow of ideas, waking dreams and hallucinations follow, more pronounced in the Asiatic than in the Caucasian, the patient passes gradually into a natural sleep. Larger doses produce sleep without the preceding state of excitement, and fatal doses are followed by coma and death in narcosis. The face is flushed and cyanosed, the pupils are contracted, the slowed respiration changes to the Chayne-Stocks type, the pulse becomes weak and irregular, the patient dies quickly from respiratory paralysis. It affects first the cortex the large ganglia cerebellum and finally the medullary centers. It relieves pain long before consciousness is lost, an important difference from the narcotics of the fatty acids. It slows respiration, which gradually becomes irregular and intermittent. Blood pressure is not affected, though peripheral vessels and especially those of the head dilate. Only large doses diminish heartforce.

The peristaltic movements of stomach and intestines can be entirely stopped, partly due to its local effect upon the peripheral nerve termini, and secretions of all the glands are diminished. Metabolism is not affected, though large doses may cause glycosuria; the effect upon the nervous system is, as in other cases, acute intoxication.

MORPHINE is intensely toxic to children and tolerance varies in adults with different individuals. Some cannot take it at all. Occasionally, it produces more or less serious disturbances, urticaria and pruritus, diarrhoea instead of constipation, great mental excitement, weakening of the heartstrength and great slowing of the pulse. The great danger during its continued administration is the forming of the morphine habit, which invariably leads to a severe chronic intoxication. Larger and larger quantities of the drug are demanded to satisfy the intense craving, so that finally enormous doses are reached. The cells of the organism acquire a resistance against its influence, they learn to live in the body fluids saturated with the drug, which is rapidly destroyed and partly eliminated unchanged by way of the intestines. An antitoxin as in the infectious diseases is not formed. The serum of such patients does not protect others from morphine poison. The symptoms of chronic intoxication are general weakness, loss of appetite and weight, insomnia, asthmatic attacks and palpitation, neuralgic pains, tremors, paresthesias, constipation changing with diarrhoea, paresis of the bladder, loss of memory, of will power, and blunting of all intellectual faculties. Sudden withdrawal of the drug may produce serious symptoms—vomiting and diarrhoea, somnolence, delirium and collapse, all rapidly relieved by a dose of morphine. It stops pain and colics no matter what the cause may be, it acts as a hypnotic, checks diarrhoea, relieves an irritating dry cough, calms the respiration and has been used successfully in diabetes melitus and insipidus. In the diseases of the peritoneum and gastro intestinal tract, to diminish or stop peristalsis, in cardiac asthmas with caution, if the heart is very much dilated, and in the incurable painful diseases, morphine is a supreme remedy.

CODEIN, methylmorphine, acts upon man very similarly to morphine, though it is far less active. It affects the physical functions less, is less constipating, less hypnotic and analgesic, but quiets cough effectually. The danger of forming the habit is slight.

HEROINE, diacetyl morphine, is more toxic than morphine and especially dangerous, as the habit is rapidly acquired. It calms respiration and increases its volume.

In acute poisoning, the stomach has to be washed out. The patient has to be kept awake and artificial respiration used, caffeine and camphor injections, if narcosis has set in and collapse threatens. The effect of atropine as an antidote is doubtful, though some clinicians advocate large doses by hypodermic injections.

Chronic morphinism is best treated in a suitable sanitarium, where the patient is under constant surveillance.

CANNABIS INDICA, Indian Hemp, derived from the female flower-tops of the plants, is used by from two to three hundred million Orientals instead of opium, tobacco and alcohol. Various alkaloids have been isolated but so far none possesses the properties of the plant. Its action is almost solely upon the higher centers. It excites the imagination and produces dreams, usually of an agreeable nature. Ideas flow rapidly, beautiful colors and sounds are seen and heard, the body feels light, passing through space, the sense of time is lost, and with all, a certain consciousness that it is only a dream, remains. Pain is diminished and drowsiness is followed by a deep sleep. Cannabis is used as hypnotic and analgesic. It relieves migraine and constant headaches from cerebral tumors, neuralgias and colics, and other pains due to various causes. It is considered a good hypnotic in acute mania and relieves suffering in incurable diseases. A habit may be easily formed and it must be given with caution on that account. The effect of chronic intoxication resembles that of opium. The intellectual faculties especially suffer.

COCAINE is derived from *Erythroxylon coca*, a native of South America, and is used by the Indians as a narcotic. It is said that the chewing of the leaves produces an agreeable state of excitement during which hunger, thirst, mental and physical depression are greatly relieved. Its local paralyzing effect upon the sensory nerve termini and contraction of capillaries, producing local anesthesia and local anemia, is its most important property. It does not pass through the skin, but is rapidly absorbed through thin mucous membranes and by hypodermic injection. It acts only as long as the solution bathes the nerve ends. The application of a ligature or a combination with adrenalin prolongs its effect. Dropped into the eye, it causes

anesthesia of the cornea and dilatation of the pupil and if given internally it produces local anesthesia of the mucous membrane of the stomach. Absorbed, it acts upon the central nervous system, causing a state of euphoria, resembling that produced by chewing the leaves of the plant. Larger doses act upon the medullary centers. Respiration becomes rapid, irregular and shallow, blood pressure rises due to contraction of vessels, the pulse becomes irregular and frequent and occasionally a considerable rise of temperature occurs. If the doses have been fatal, tetanic convulsions, collapse and death follow, due to paralysis of respiratory and circulatory centers. Chronic intoxication is marked by loss of appetite and emaciation, mental apathy and maniacal states and just as with the morphine habit, larger and larger doses are required to satisfy the craving.

Cocaine was first introduced as a local anesthetic by Koeller in 1884, and has since then gained more and more in importance, as it permits surgical operations to be performed under local anesthesia, which formerly were only possible with general anesthesia. When combined with adrenalin, it is kept long in place, on account of the vaso constricting power of this substance. The toxic effect is lessened, it is locally destroyed, the anesthesia is prolonged and a diluted solution may be effectively used. To anesthetize a larger area, stronger solutions of cocaine, or its combination with adrenalin are injected along the nerve trunk, permitting extensive operations in the field of distribution of the treated nerves. This method "regional anesthesia" is especially useful for the extremities. An injection into the spinal canal by lumbar puncture, brings the alkaloid in direct contact with the vertebral column, the sheathless nerves and ganglia within the meninges, producing an anesthesia of great intensity and extent. The introduction of stovaine and other similar substances has made this method less dangerous and it is now widely used. Aside from its employment to produce local anesthesia, cocaine has found little application. It is recommended as a respiratory and cardiac stimulant. Whenever prescribed it must be remembered that a dangerous habit is readily established. An antidote does not exist and cases of acute poisoning have to be treated symptomatically.

A large number of compounds, synthetically similar to Cocaine and less toxic, have been introduced. One of the earliest EUCAINE, trimethylbenzoxypiperidine, used in form of the hydrochloride or lactate. It does not contract the vessels, and

does not dilate the pupils. Its toxicity is 1-4 to 1-6 less than that of cocaine. Tropococain, Benzyl-methyl-pseudotropein, found in the cocoa-leaf and synthetically prepared, is frequently used in spinal anesthesia. Its toxicity is 1-3 less than that of cocaine. Other similar preparations are Stovaine, Aल्पine and many others.

ATROPINE, *Atropa Belladonna*, *Datura Stramonium*, *Scopola carniolica* and *Hyoscyamus niger*, all belong to the family of the Solanaceae, and contain the alkaloids Hyoscyamine and Scopolamine or Hyoscine and Atropine, the latter in very small quantities in the young leaves. During the process of extraction, a part of the hyoscyamine is converted into atropine. It is optically inert and consists of dextro and laevo rotatory hyoscyamine. The alkaloids are all isomeric and when treated with an alkali split into an acid and a base, tropic acid and tropine; scopolamine into tropic acid and scopoline

Atropine acts upon nervous centers and upon the end organs of the peripheral nerves. It has selective properties for both. When dropped into the eye, it dilates the pupil, due to paralysis of the nerve ends of the oculo motor nerve fibers supplying the sphincter of the iris. It increases intraocular pressure and it is dangerous, therefore, to apply it in glaucoma. Its action upon the sphincter of the iris is local and prolonged and appears in from ten to fifteen minutes. The pupil remains dilated from one to two days and returns in from ten to twelve days gradually to the normal. When absorbed it has a depressing effect upon all glands that are supplied by secretory nerves, saliva and bronchial secretions and the milk of nursing women is diminished, the mouth, nose and throat feel dry, perspiration ceases, the quantity of urine voided is decreased and the secretion of the glands of the gastro intestinal tract are more or less checked. The nerve ends of the vagus to the heart are paralyzed, the pulse quickens and blood pressure rises, the peripheral vessels are dilated, the face is flushed, the splanchnics contracted. Its paralyzing effect upon the vagus fibres to the lungs that cause contraction of the smaller bronchi sometimes makes atropine an efficient remedy to treat short asthmatic attacks and it is a respiratory stimulant by its action upon the respiratory center. The muscular motor nerve ends are paralyzed by large doses, as well as the cutaneous sensory nerve ends. The belladonna plaster is a common remedy for its local anodyne effect. Peristaltic movements of the intestines depending on

the motor nerve centers alone, are completely arrested, best shown, when the circular fibres are in spasmodic contraction, small doses by stimulating the plexus of Auerbach increase peristalsis and by paralyzing the vagus ends decrease it. Other organs that contain involuntary muscular fibres, like the bladder, uterus and stomach, are also relaxed when spastically contracted, after large doses of atropine. The action of atropine upon the cerebral centers is first stimulating, then paralyzing. A state of excitement resembling an active delirium is followed by somnolence, coma and death due to asphyxia.

The therapeutic use of atropine is largely due to its action upon nerve centers, as well as upon peripheral nerve endings. It is the most important remedy of the oculist for diagnostic purposes and for the treatment of the diseases of the iris and cornea. It is the most efficient agent to check glandular secretions and is used to stop night sweats of phthisis, abort colds, give relief in hay fever, influence hyperchloridia, lessen bronchial secretion in bronchorea and check the profuse watery discharge of various intestinal affections.

As an antispasmodic it is useful in colics of any description and freely employed to relieve pain due to spasms of voluntary and involuntary muscles. I have treated successfully a number of patients, suffering from Raynaud's disease of nervous as well as of toxic origin, among them diabetics and others that had in previous attacks their gangrenous toes amputated. In whooping cough it is a supreme remedy given in minute and repeated doses to relieve the spasms. The intense pains of gastric crisis in tabes dorsalis have also been relieved by the writer in some cases, with this remedy, when morphine has failed, and in epilepsy it has been successful when the bromide has been given without relief. In strangulated hernia it has frequently given excellent results. It acts as an efficient hemostatic in internal hemorrhage by drawing the blood to the periphery, and in collapse combined with other drugs, it is of great value. It is a valuable eliminant and is used to relieve uremic attacks. Acute atropine poison has to be treated symptomatically. The prognosis is mostly favorable.

HYOSCYAMINE closely resembles atropine, though milder in its action, and the indications for its use are practically the same as for atropine. It possesses a calming effect in states of excitement and produces sleep. On account of this property, it is freely used in the hospitals for the insane.

SCOPOLAMINE or Hyoscine, an alkaloid consisting of tropic acid and scopoline, is used especially for its calming effect and as a hypnotic to increase the power of other hypnotics in delirium tremens and in maniacal excitement, in paralysis agitans and in multiple sclerosis, it often gives temporary relief. Its effect upon the pupil, the secretory glands and muscles resembles that of atropine. A combination of hyoscine and morphine has been used to produce surgical anesthesia. It was introduced by Schneiderlin in 1900. Wood collected two thousand cases, with nine deaths, a percentage of one death in two hundred and twenty-two cases, and in 69% of these cases ether or chloroform was required to produce sufficient anesthesia for operation. Lamphear of St. Louis, who has used this combination reports eight deaths in ten thousand cases. In some of the fatal cases, he claims that it has not been definitely proven that death was solely due to the method.

He uses hyoscine hydrobromide made from *hyoscyamus niger* and believes that the better results obtained are due to this fact, as this alkaloid differs materially from scopolamine.

The method is contra-indicated in advanced nephritis, in diabetes mellitus and in operations on the throat, when there is danger that blood will escape into the larynx. According to Poulsson, it produces a specific narcosis of a small cerebral area, saving the rest of the entire nervous system, he advises caution and a thorough knowledge of the technique.

PILOCARPINE is contained in the leaves of *Pilocarpus Jaborandi* and *Pilocarpus microphyllus*, with various other alkaloids. Its action is diametrically opposed to that of atropine. It stimulates the nerve ends, paralyzed by atropine. Small doses flush the skin, cause profuse salivation, perspiration and lachrymal and bronchial secretions, slow pulse frequency and contract the pupil. The quantity of urine is first increased, then decreased, on account of the enormous loss of liquid by other channels, and intraocular tension is lessened after being first increased. In large toxic doses, it paralyzes the central nervous system, causes heart weakness, diarrhoea, convulsions, coma and death. It is used therapeutically, as an efficient diaphoretic, especially in cases of edema, not due to heart disease, and in pruritus, when the skin is dry and the cause unknown. In the beginning of a cold, it may be used to produce sweating and relieve venous congestion and it may be used for the same reason at the onset of the acute infectious diseases. It acts as an expectorant by liquifying the mucus; it

stimulates hair growth and in some cases restores its color. It has been employed in deafness due to dry catarrh and is highly recommended by Waugh as a remedy in erysipelas and by Robinson in cases of syphilis that are saturated with mercury and do no longer respond to the action of the metal. Pilocarpine by enormously increasing glandular activity renews the action of the mercury deposited in the system.

LOBELINE contained in the leaves of *Lobelia inflata*, Indian tobacco, a plant growing in the eastern portion of the United States. Small doses paralyze the peripheral fibres of the pneumogastric to the lungs and cause relaxation of the bronchi. Its action upon the medulla is stimulating, the respiration becomes more frequent and of greater depth. The pulse is at first slowed accompanied by fall of blood pressure, followed by acceleration of the pulse and rise of pressure. The secretory glands are first stimulated, then depressed. Its action upon the vomiting center makes Lobeline an efficient emetic. It is used as an antispasmodic expectorant and general relaxant, especially in the diseases of the bronchi and has found its chief employment as an anti-asthmatic remedy.

SPARTEINE is contained with Scoparine in the tops of *Cysticus Scoparius* broom plant. It stimulates the heart directly, neither increasing nor decreasing the blood pressure. It regulates the heart's action, its effect is rapid, intense and persistent. In toxic doses it paralyzes the spinal cord, the peripheral motor nerve ends, the inhibitory centers of the heart and it causes death by paralyzing the phrenic nerve. It is readily eliminated by the kidneys without exerting any diuretic action and can be given to patients with advanced nephritis. The sulphate is usually employed as a heart tonic in cardiac disease. The reports of various investigators differ so much as to the action of Sparteine upon the circulation and kidneys that it seems probable that different substances have been used by them.

PHYSOSTIGMINE or ESERINE is derived from *Physostigma venenosum*, the Calabarbean, which contains also calabarine, an alkaloid resembling strychnine in its action and eseridine, which acts similarly to physostigmine.

Physostigmine paralyzes the central nervous system and causes death by paralysis of the respiratory center. It contracts the pupil, lessens intraocular tension and acts upon voluntary and involuntary muscles. After toxic doses, muscular twitchings are

observed, even during chloroform narcosis, excluding a central cause. Vomiting and diarrhoea of fecal matter followed by mucous bloody discharges, are due to violent contractions of the muscles of stomach and intestines pressing at the same time the blood from mesenteric veins and arteries. This accompanied by contraction of the smaller arteries causes a rise of blood pressure. Its action upon the secretory glands resembles pilocarpine. It increases perspiration, the flow of saliva, of pancreatic juice and of the lachrymal secretion. Its therapeutic use is principally confined to the treatment of the diseases of the eye; in glaucoma, to lessen intra-ocular tension; in peripheral corneal ulceration, to prevent prolapse of the iris. It is alternated with atropine to loosen adhesion of the iris, and to control the pupil after the use of atropine for diagnostic purposes. Waugh recommends it highly in chronic constipation and as a never failing remedy in flatulency. In tetanus it has given occasionally favorable results. In epilepsy it increases the convulsions. It has been recommended in complete intestinal paralysis, following laparotomies to be given in these cases by hypodermic injection. Atropine is an antidote and should be used in acute intoxications after the stomach has been evacuated. The further treatment is symptomatic.

ACONITINE, derived from *Aconitum Napellas* Monkshood, a plant growing in the meadows of the Alps, is characterized by its multiplicity and intensity of action. It is highly toxic, a few drops of the tincture have caused death. It first excites, then paralyzes sensory and secretory nerves. It produces numbness and tingling in tongue, lips and fauces when the solution is held a few minutes in the mouth and when taken in repeated small doses or in one large dose, the same sensations of numbness and tingling are also felt in toes and finger tips.

These are important symptoms to note during its administration for therapeutic purposes. They show that the system is under the influence of the alkaloid and that the dose should not be repeated until these symptoms have entirely disappeared. The tingling is produced by the paralysis of the peripheral ends of the sensory nerves. A number of prominent writers have warned against the use of aconitine as dangerous and unsafe and the pharmacopoeias of various countries do not discuss it at all.

On the other hand, Bruggraeve and his pupils place it at the head of the list. This discrepancy of opinion is probably due to the impurity and varying strength of products obtained in the

pharmacies. In the United States the alkaloid is widely used. Waugh states that one house has sent out in the last fifteen years 50,000,000 granules, each containing 0.000,5 gm. of amorphous aconitine or of the crystalline aconitine, without the report of a single fatal case or of alarming toxic symptoms.

Aconitine is absorbed through the skin and mucous membranes. It stimulates the cardio-inhibitory center, slows the pulse, prolongs the diastole and lowers blood pressure caused by the slowing of the pulse. Section of the vagus is followed by increase of pulse rate.

The vasomotor center is first stimulated then depressed, temperature lowered and salivation increased. Increased perspiration is a sign of depression. The pupil is first contracted and then dilates.

Large toxic doses cause irregularity of auricular and ventricular action and wormlike movements of the heart, emptying it but little. Vomiting, convulsions and death, due to heart and respiratory paralysis, follow in less than half an hour.

The general antidote for alkaloid poison is tannic acid. The stomach has to be emptied, caffeine or coffee administered and artificial respiration when the respiration is labored. Atropine counteracts the stimulating effect upon the vagus, but is useless when the pulse is rapid, due to paralysis of this center. Aconitine is of the greatest value in all inflammatory conditions, accompanied by congestion, due to its equalizing effect upon the circulation. It bleeds the veins into the arteries.

When pure aconitine is administered in small and repeated doses to effect or till the characteristic tingling is noted, the first toxic symptom, then discontinued and given less often, it is absolutely safe. It is invaluable at the onset of acute infectious disease marked by congestion. Chills, fever, and pain stop; the cyanosis disappears, the pulse is slowed and softened, the respiration quieted, the temperature lowered, the skin becomes warm, the equilibrium between arterial and venous circulation is restored. If it is given to lower temperature, it must be remembered that only hyperpyrexia is dangerous. Its paralyzing effect of the peripheral ends of the sensory nerves, together with its action upon the circulation makes it a valued remedy in neuralgias. It is said to cure tinnitus aureum.

VERATRINE, *veratrum viride*, contains a number of alkaloids. Veratrine is absorbed by the skin and the mucous mem-

branes. It is rapidly eliminated by the kidneys. It acts as a stimulant upon the secretory nerves, increasing the flow of saliva, the perspiration and the quantity of urine. It stimulates the peripheral inhibitory nerves and medullary centers and is followed by paralysis. It lowers temperature and it tones up striated muscular fibres, the contractions produced by it are prolonged. Directly applied to the skin, it causes a sensation of burning followed by cold and anesthesia. In toxic doses it causes nausea, vomiting, purging and death by cardiac and respiratory paralysis.

The indications for its therapeutic use are similar to those of aconitine. It is especially useful in acute inflammations and febrile diseases and in neuralgias. Aconitine as well as veratrine may be advantageously combined with digitaline and strychnine, to counteract their depressing effect upon the heart. As to the safety of its administration, the same may be said that has been said of aconitine. If given in small and repeated doses to effect, or to slight nausea, the first toxic symptom, it proves an absolutely safe and efficient remedy.

COLCHICINE is derived from *Colchicum autumnale*, meadow saffran, a methyl compound of Colchicine. It differs from other alkaloids by its acid reaction. It acts upon the nervous system central and peripheral. It increases the flow of saliva, of bile and of urine, and produces profuse watery evacuations several hours after its administration, which become mucous and bloody when larger doses are taken. Articular surfaces and bone marrow are congested and an increased amount of uric acid is found in the urine. Toxic doses are followed by severe abdominal pain, nausea, vomiting, diarrhoea of mucous and bloody stools, cold perspiration, general malaise, depression and collapse. Colchicine has been and is still the supreme remedy in gout; its specific action upon articular surfaces, producing hyperemia and its great eliminative power explain why it has held its prominent place in this disease for ages.

EMETINE of glucosoid nature, a methyl compound of cephalin is derived from the radix *Ipecacuanha*. It acts upon skin and mucous membranes, and causes an inflammation with formation of vesicles and pustules when it is left for a longer time in contact with them. When inhaled, it produces running of eyes and nose, hoarseness, cough and in some persons, asthmatic attacks. Larger doses cause profuse bronchial secretions, nausea, and vomiting with slight collapse symptoms. Diarrhoea may follow, if the alkaloid has not been expelled.

Subcutaneously or intravenously injected into animals, it causes vomiting and a severe gastroenteritis, edema of lungs and red hepatization. It paralyzes the vasomotor center, lowers blood pressure and causes death by cardiac paralysis. It is eliminated by the gastrointestinal mucosa and by the kidneys and its emetic action is thought due to its local effect, by reflex. It is still used as an emetic, though inferior to apomorphine, and it is widely employed as an expectorant in dry catarrhs and in gastrointestinal affections, to increase secretions. In chronic constipation, it is usually combined with other remedies. Ipecac and its alkaloid, has a great reputation in amoebic dysentery, and has recently been recommended in pyorrhoea and various other affections.

APOMORPHINE is produced by the action of hydrochloric acid upon morphine, which loses a molecule of water and with it the characteristic properties of this alkaloid. It stimulates the vomiting center and causes nausea, and vomiting. If given by hyperdermic injection it acts promptly, evacuating the stomach, within ten minutes, nausea is of short duration and the stomach not irritated. It is an efficient remedy in cases of narcotic poison with loss of consciousness, and to remove foreign bodies from the oesophagus and bronchi. Its effect upon the bronchial secretions makes it useful as an expectorant.

THE DIGITALIS GROUP. Most of the active principles of this group are glucosoids. Several of them are frequently contained in the same plant and often associated by substances resembling the saponines. The most important plants of this group are *digitalis purpurea*, or foxglove, and *strophantus*. The seeds of *digitalis* contain digitalin and digitoxine, the latter is also contained in the leaves of the plant from which are derived digitophyline and digitalein. *Strophantine* is derived from *strophantus gratus*. All exert a characteristic action upon the heart and are classed as heart stimulants. Their administration in therapeutic doses is followed by a slow and full pulse and rise of blood pressure. The diastole is lengthened and the systole becomes vigorous and strong, emptying the ventricles completely and throwing a larger volume of blood into the arteries; the veins are drained, blood pressure rises, the equilibrium between the arterial and venous system is re-established and an irregularly beating heart commences to act regularly. All arteries are at the same time contracted, with the exception of the renal arteries,

and contribute to the rise of blood pressure. The arterial contraction cannot be noticed when digitalis is given in therapeutic doses.

When larger doses are administered or the accumulative action of digitalis becomes manifest, due to a too prolonged administration, the pulse becomes slower and may fall to forty beats per minute. The volume of blood in the arteries is diminished and blood pressure lowered, followed by a bigeminal and trigeminal pulse, which is hardly felt in the peripheral arteries. Toxic doses cause rapid and irregular pulse, delirium cordis and death in diastole. The diuretic action of this group depends entirely on the action upon the heart in circulatory disturbances. They will promptly remove edemas by improving the circulation. The cumulative action of digitalis is rarely observed in practice and more dreaded than it deserves. The symptoms are those of intoxication, an excessively slow pulse, or a pulse becoming suddenly rapid, accompanied by headache, malaise, dizziness, delirium, nausea and vomiting. Probably every physician has given digitalis for weeks at a time without observing these symptoms. A patient of mine has taken it for more than two years in small doses, without showing any signs of intoxication.

The most important action of digitalis is its effect upon the circulation, re-establishing the equilibrium between the arterial and venous pressure, whether the cause of the disturbance is a disease of the heart, or an obstruction in the systematic circulation, disease of the lungs, liver, etc.; though it acts best in cardiac disease. It is contra-indicated when the compensation is perfect. The effect is usually prolonged and may last weeks, months and even years. If once a perfect circulation is restored by this medication, it means more blood and purer blood to the heart muscle, which in consequence hypertrophies to compensate for the deficiency. It is of value in the acute infectious diseases to tone up a weakened heart and in myocarditis when enough muscular tissue is left to be acted upon. Its action is slow and the effect is not observed till hours after its administration. According to Fraenkel digitoxin requires sixty hours and digitalin thirty to develop their action. Its continued use causes loss of appetite, nausea and diarrhoea. The most frequently used preparations are probably digitalin and digalin, rapidly absorbed and quickly acting.

Strophantus is inferior to digitalis. The indications for its use are the same. It acts more rapidly and can be employed to

commence the treatment, which is to be continued with digitalis. The galenic preparations are unreliable and the glucosoid should be used in preference. It does not contract the arteries and is of advantage in cases where this is an undesirable feature.

The fresh infusion of digitalis acts occasionally when the other preparations of digitalis have failed.

APOCYNUM, CONVALLARIA, ADONIDINE AND SQUILLS belong to this group:—

THE SAPONINES ARE GLUCOSOIDS, the chemical relationship has not been determined. They foam in watery solutions like soap. The toxic saponines are generally called Saprotoxines. Nearly all of them are toxic when directly introduced into the blood and produce destruction of red blood corpuscles, enteritis and convulsions. Notwithstanding, most of them can be given in large doses by mouth; they do not pass a healthy mucous membrane and are decomposed by the ferments and alkalies of the intestines to inert substances. They irritate the various mucous membranes, cause increased secretions of conjunctiva, nose, throat and bronchi and given in very large doses may cause vomiting and diarrhoea. The indications for their use are very much the same as those for emetine.

SENEGA and QUILLAJA are useful as expectorants when cough is desirable to free the bronchi from an accumulation of mucous. Sarsaparilla and Guajac have been formerly largely used in syphilis, but at present have been almost entirely abandoned for this purpose. A specific action by these drugs upon this disease has not been shown.

THE GROUP OF CAFFEINS are valuable remedies, and are closely related to various substances, such as uric acid and Xanthin, found in the animal organism. All may be derived from Purine and are, therefore, called purine bodies. Caffeine, the most important of this group is contained in the coffee bean, in the leaves of tea, the Kolanut and various other plants. It is rapidly eliminated by the kidneys, partly unchanged and partly as monomethyl and dimethyl Xanthine. It acts upon the central nervous system and striated muscles. Caffeine produces wakefulness and stimulates the intellectual functions, the association of ideas and perception of sensory impressions. Large doses cause a feeling of anxiety, restlessness, palpitation, frequent and tense pulse, roaring in the ears, delirium, tremor and occasionally convulsions.

In animals, it acts especially upon the spine, causing increased reflex irritability, spasms, tetanic convulsions and death due to asphyxia. Therapeutic doses increase the muscular tone of the skeletal muscles and of the heart, which enables the organ to overcome peripheral obstructions. The pulse is slowed and blood pressure rises slightly, due to central stimulation and increased heartforce. The splanchnic vessels, due to stimulation of the vasomotor center, contract, whereas the peripheral vessels, coronaries and renals dilate, due to its action upon the vessel walls. Respiration becomes more rapid and of greater depth and diuresis is much increased. A greater volume of blood passes through the dilated vessels of the kidneys and a stimulation of the epithelial cells probably adds to its diuretic effect.

Caffeine is used as heart stimulant alone or in combination with digitalis, as nerve stimulant in narcotic intoxication—morphine, chloroform, ether, alcohol, etc. In headaches, especially in migraine, combined with phenacetine and potassium bromide, it relieves by dilating the cerebral vessels and by equalizing the cerebral circulation. It is used as a diuretic in nephritis and as a respiratory stimulant.

THEOBROMINE AND THEOPHYLINE, DIMETHYLBXANTHINE, are powerful diuretics and useful in the diseases of the kidneys and heart with edema; they increase the quantity of the urine and its amount of solids. They act especially well when the glomeruli are intact. In angina pectoris and advanced arteriosclerosis, they ameliorate the symptoms. They resemble caffeine, though their action upon the nervous system and circulation is less marked. In larger doses they may cause headache, nausea and vomiting, and theophylline has caused epileptiform attacks. It has to be used with caution. The double compound of Theobromine and sodiumsalicylate, diuretin, is frequently used instead of either of these preparations as it is more readily absorbed. It acts like the former as diuretic of great power.

THE CAMPHOR GROUP. Common camphor is derived by boiling the wood of the root of *Cinnamomum Camphora*, a native tree of China and Japan. It reddens the skin when applied locally and produces a burning sensation followed by cold and salivation. It dissolves in 1000 parts of water and its absorption is on that account slow through skin and mucous membrane. Its action is rapid when given by hypodermic injection, dissolved in oil. Camphor exerts a mild sedative action upon the intellectual

centers when given in small doses, and causes first a state of excitement followed by depression and sleep when given in larger doses, and by coma and death, when the dose has been toxic. The prognosis is good in most cases; it is rapidly converted into non-toxic compounds in the body. Its effect upon the circulation is increase of volume and tension of the pulse, the heart action is improved and blood pressure raised, especially manifest when the organ is weak. Respiration is slowed and deepened. It is excreted as Camphoglycuronic acid by the urine, and a small portion of it is eliminated unchanged by the lungs. Camphor is used locally in forms of Spirit of Camphor and Camphor liniment as counter irritant, by mouth or hypodermic injection as a nerve sedative and as respiratory and circulatory stimulant in states of depression and collapse. In serious diarrhoeas it is a tonic to the intestinal mucous membrane. On account of its slight antiseptic properties it is very generally used to kill moths.

MENTHOL, sometimes called peppermint camphor, is derived from peppermint oil of the Chinese and Japanese species. When locally employed, it possesses greater antiseptic powers than the Java Camphor, it contracts the vessels and produces a decided sensation of cold, followed by local anesthesia. It acts like camphor upon circulation and respiration, but even in small doses depresses the central nervous system. It is used locally in migraine, in neuralgias, in colds applied to the mucous membrane of the nose and when given by mouth is occasionally useful in sea sickness and other causes of nausea and vomiting. It is of value as an intestinal antiseptic to diminish excessive fermentation.

ERGOTINE is the sclerotinum—compact mycelium or spawn—of *Claviceps purpurea*, a fungus, which infests the grain of rye and various grasses. It contains a number of active principles of which ergotoxin or hydroergotinine is one of the most active. Besides this alkaloid a number of active amines have been isolated from the watery extract.

The ergotine sold by the manufacturers is a hydro-alcoholic extract of the strength of the official extract, representing the general powers of the drug. If ergot is given by mouth or by hypodermic injection it contracts the smaller arteries, those of the pulmonary circulation included. This and the formation of hyaline thrombi adhering to the vessel walls may cause complete

occlusions of their lumen and produce dry gangrene when larger doses of the drug are taken. The arterial contraction is due to central and peripheral stimulation. The formation of the thrombi is probably due to changes, which take place in the intima of the vessels.

It causes powerful contraction of the gravid uterus by stimulating its spinal center, stops post partum hemorrhage by closing the vessels, raises blood pressure, dilates the pupil, increases intestinal peristalsis and diminishes the flow of saliva, of perspiration, the milk of nursing women and of urine. In toxic doses it produces spastic contractions of stomach and intestines, accompanied by vomiting and diarrhoea and clonic and tonic convulsions, resembling epileptic attacks.

The symptoms of acute ergot poisoning are excessive thirst, vomiting, diarrhoea, headache, epileptiform attacks, uterine hemorrhages and abortion in pregnant women.

Chronic Ergotism, due to ingestion of bad rye flour, gives rise to two forms of intoxication, the gangrenous and the convulsive form. Formerly frequent, they are now rarely observed. The former commences with coldness, numbness, severe pain and abnormal sensations in the extremities, followed by the formation of bullae, filled with blood and cloudy serum, and gangrene of fingers and toes. Recovery takes place after change of the flour in some cases, with loss of whole extremities. In other cases, death is due to pyemic infection or gangrene of the lungs. The convulsive form commences with severe headache, dizziness, pain, paresthesias and anesthetics spreading from fingers and toes over the whole body, excessive thirst and hunger, vomiting, diarrhoea, epileptiform attacks ending in death or in insanity in a few days or weeks. Therapeutically it is largely used to stop post partum and uterine hemorrhages not connected with pregnancies, in endometritis and in benign tumors of the womb. In diabetes insipidus it is often curative and it has been used with advantage in diabetes mellitus. It is recommended in septic conditions, it improves the circulation and especially the circulation in and around the septic focus.

In epilepsy it aids the bromides in their action and is efficient in enlargement of the spleen and inflammations of the mucous membrane and in diarrhoea.

QUININE—is the most important alkaloid of a large number derived from the bark of the cinchona tree, a native of South America, growing on the slopes of the Andes. It is a general

protoplasmic poison and acts first stimulating then paralyzing upon cells of every description. Infusoria and amoeba die rapidly in a 1% solution of the alkaloid and its salts and in a few hours when the solution has been diluted to 1:20,000, and traces of quinine will prevent development and growth of the plasmodium malariae. Vegetable micro-organisms are less affected. The Cholera bacilli cease to grow in a solution of 1:5000 and Anthrax bacilli in one of 1:650.

The white blood corpuscles resembling morphologically the amoeba are affected like these. They lose their movements in a solution of 1:20,000 and are destroyed in more concentrated solutions. A pronounced leucopenia follows the administration of quinine in man. Metabolism is interfered with and the excretion of urea, of sulphuric acid and phosphoric acid is proportionately decreased with the increase of the dose of quinine.

It probably paralyzes the ferments that aid in the chemical processes of the organism. It lowers body temperature in fevers by lessening heat production, contrary to the modern antipyretics that produce the same effect by heat loss. It stimulates heart and striated muscles in small doses, and acts depressing when given in larger doses. It decreases the size of an enlarged spleen and causes uterine contractions. It is a nerve stimulant in small doses, and it produces dizziness, headache, roaring in the ears, deafness, amblyopia and even complete and permanent deafness when given in large doses. Toxic doses may cause death by respiratory and cardiac paralysis. Quinine is found in the urine thirty minutes after its administration and traces may be detected for seventy-two hours—60% to 70% is decomposed in the organism. Occasionally it produces, in persons sensitive to it, urticaria, exzemas, edemas and blood extravasations under the skin. It is specific in malaria and in amoebic dysentery; it destroys the micro-organisms without damaging the body cells. In form of hydroquinine synthetically prepared it kills trypanozomes. It is useful in whooping cough and occasionally in neuralgias and it is a good antipyretic. It is also widely used as stomachic and as a general tonic.

THE ANTIPYRINES. They are all derived from benzene, a coal tar derivative and owe their importance to their faculty to lower temperature and to stop pain. They are antipyretics and analgesics. Up to the latter part of the last century, it was thought of supreme importance to lower the temperature in all febrile diseases, and a diligent search made for means that accom-

plish this without doing harm to the system led to the discovery of these remedies. More recent studies revealed that the thermo regulating centre tends to maintain a constantly higher temperature than the normal in these diseases, which is only modified by the administration of the antipyretics as long as they are active—that is, after a certain length of time, the temperature will return to its former level. As it was further shown that a high temperature aids in the destruction of micro-organisms, these agents are at present not so frequently employed and only used to lower an excessively high temperature, which would damage the organism, if allowed to continue.

Quinine was long known to possess antipyretic properties and the search to find substances that act similarly led to the discovery of the coal tar derivatives.

ANTIPYRINE, phenyl-dimethyl-pyrazolon is a white crystalline powder of bitter taste. It lowers temperature promptly for several hours accompanied by free perspiration. Blood pressure is not influenced by it, as the widening of the peripheral vessels is compensated by a contraction of the vessels of internal organs.

It first stimulates the nervous system and then acts depressingly. Therapeutic doses do not affect the heart. Large doses continued for some time, produce convulsions followed by paralysis. Locally applied to mucous membranes it paralyzes the peripheral nerve ends. Especially on the sensory nerves, it acts anesthetically, styptically and mildly antiseptically.

Some persons are very sensitive to it and react with disagreeable symptoms when the dose has been too large. Nausea, vomiting, profuse perspiration, drop of temperature to the subnormal with collapse symptoms and chills, skin eruptions of various character, and occasionally a sudden rise of temperature follow an excessive administration. It is well to commence with small doses and to repeat to effect, until the average dose is ascertained.

Therapeutically it is used as an efficient antipyretic in hyperpyrexias, and its analgesic properties make it a good remedy in migraine, in neuralgias and other painful affections. It is usually combined with caffeine. In acute articular rheumatism it seems to possess a specific action, similar to the salicylates, though less strong, and in various motor neuroses, especially in chorea, it has occasionally given good results. It is effective in epilepsy.

ACETANILIDE, antifebrin or phenylacetamide, is an aniline in which one atom of hydrogen has been replaced by an acetyl

radical. It is of greater toxicity than antipyrine, due to the setting free of aniline, which destroys the red blood corpuscles of the blood, forming methemoglobin and causing cyanosis. It resembles antipyrine closely in its antipyretic and analgesic properties and is used in the affections in which antipyrine is useful. Continued use may produce anemia and weakness, and it should not be administered to weak and anemic patients. It is the most toxic of the agents of this group, yet widely used on account of its cheapness. It is a constant ingredient of the headache powders sold in drug stores.

PHENACETIN, a phenol-derivative, is the best and safest of this class, though if given in large doses it may cause cyanosis. Its action is slower than that of the other antipyretics, which it closely resembles, and like these is used in febrile diseases, in headache, neuralgias, whooping cough, etc. The toxic symptoms, cyanosis, profuse perspiration, chills and collapse, it shares with all. These preparations do not act as antipyretics by lessening heat production like quinine, but they lower temperature by increasing heat loss. Widening of peripheral vessels and contraction of the splanchnics forces large quantities of blood to the surface, where cooling is favored by evaporation of the perspiration.

THE NARCOTICS OF THE FATTY ACID SERIES

The "Methan derivatives" act upon the central nervous system depressing and paralyzing. They affect first the brain, then the spinal, and finally the medullary centers. Their usefulness depends on the dose required to depress the cortical centers without affecting the medullary centers. If for both it is small the substance is useless, as it then endangers life. If on the other hand the dose is small for the former and large for the latter, it is eminently useful and safe. The introduction of Chlorine and Bromine into these compounds increases their narcotic properties. The harmless Methan CH_4 is converted into the active Chloroform C H Cl_3 and Ethylchloride $\text{C}_2 \text{H}_5 \text{Cl}$ is derived from $\text{C}_2 \text{H}_6$ by introducing Chlorine into its molecule. They are less soluble in water than in fat, and carried by the blood stream they are dissolved in the serum, pass into the nerve cells, and form soluble compounds with their lipid tissue. Their action depends on the rapidity of absorption and elimination. If absorbed and eliminated rapidly, as volatile substances, chloroform and ether, they act

as general anesthetics; if slowly absorbed and eliminated, their action is less intense, but of greater duration. They act then as hypnotics.

THE ANESTHETICS. The most frequently used anesthetics are ETHER ($C_2 H_5$) O_2 and CHLOROFORM $C H Cl_3$. When inhaled with air they irritate the mucous membranes, causing burning sensation in the mouth, flow of saliva and of tears, cough and occasionally vomiting. Their irritation of the mucous membrane of the nose may be followed by shallow breathing or even by momentary stopping of the respiration. Passed into the bronchi, they irritate the sensory fibres of the vagus, increasing frequency of respiration and of pulse. They are absorbed by the blood in the lungs.

A state of excitement, resembling that produced by alcohol intoxication usually marks the beginning of absorption. During this period the face is flushed, the skin is warm and moist and the pupils commence to contract. According to Kapelin, this state of excitement is not the consequence of stimulation, but of paralysis of the higher intellectual centers, during which motor centers uncontrolled by consciousness continue to act. Soon the depressing and paralyzing effect becomes manifest, the state of excitement is followed by a deep sleep. Reflexes are abolished, voluntary muscles relax and analgesia is complete, the pupils are contracted, the pulse full, slow and regular, the breathing slow and the face cyanosed in ether and pale in chloroform narcosis. Function of brain and spinal centers are abolished but the medullary centers are but little influenced. The slowed respiration and pulse show that these centers are not entirely unaffected, and if the inhalation is continued too long, both become rapid, irregular and frequent and death due to respiratory and cardiac paralysis follows. If inhalation is discontinued before collapse symptoms appear, the sensation of pain and the reflexes return and the patient awakes usually within 15 minutes with more or less nausea, headache and vomiting.

The blood pressure is but little influenced by ether but invariably lowered by chloroform during narcosis. Ether paralyzes mainly that portion of the vasomotor center which presides over the vascular supply of the face and the cortex of the brain, whereas, chloroform causes complete vasomotorparalysis with consequent drop of blood pressure. Ether affects the heart little in narcosis, whereas, chloroform weakens auricular and ventricular contractions.

The respiration is affected by both anesthetics alike, and death, when the inhalation has been too long continued, is due to respiratory paralysis as shown in a large number of animal experiments. If, as a matter of fact, most patients die during chloroform narcosis of cardiac failure, it is thought to be due to degenerations of the heart muscle not diagnosed. Chloroform and ether act as protoplasmic poisons, especially the former; fatty degeneration of heart, of the kidneys and of liver have been observed after chloroform anesthesia, and glycosuria and albuminuria after ether narcosis. Both are excreted by way of the lungs and chloroform in small quantities through the kidneys, increasing the amount of chlorides eliminated. Ether is safer than chloroform, it acts less strong upon the heart and respiration. It is used with preference since the frequent pulmonary affections, pneumonia, bronchitis and edema of lungs, following its administration have been found due to aspiration of mucous from mouth and throat and that they can be largely avoided by lowering the head, by using the anesthetic well mixed with air and by removing the mucus by swabbing out mouth and throat frequently.

CHLOROFORM and ether are used to produce general anesthesia for surgical operations to stop convulsions and in obstetrical practice, cautiously, at the end of the parturient act to stop pain. The quantity needed in these latter cases is very small, a few whiffs from time to time, are sufficient.

Chloroform, is used locally as a liniment for the irritating and paralyzing effect it has upon the sensory nerve ends.

Ether mixes readily with alcohol and water and is given to relieve hysterical paroxysms and flatulency and as a stimulant by hypodermic injection in collapse. Its effect upon the circulation and respiration is due to reflex caused by the pain of the injection.

Before using chloroform or ether to produce surgical anesthesia, a thorough examination of the patient has to be made. Diseases of the heart, of the lungs, and kidneys and of the brain as well as aneurysm and chronic alcoholism are contra-indications for their use. If dangerous symptoms appear during the administration, a suddenly dilated pupil, slow shallow respiration, a weak and small pulse, etc., the administration of the anesthetic must be at once discontinued the windows opened the head lowered and artificial respiration and cardiac massage commenced. Camphor strychnine and ammonia by hypodermic injections and adrenalin by intravenous injection may be tried.

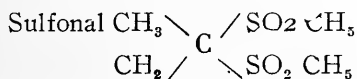
ETHYLBROMIDE— $C_2 H_5 Br$. is used as general anesthetic in minor surgery, and in dentistry for the extraction of teeth. Its action is rapid and safe, if the preparation is pure and the amount given does not exceed from ten to fifteen gm. A deep narcosis is dangerous, respiratory paralysis follows spinal paralysis—abolishment of reflexes—in quick succession.

THE HYPNOTICS of the fatty acid series do not differ in their action upon the nervous system from the anesthetics, in so far as they affect in turn the brain, the spine and finally the medulla. They are, however, slowly absorbed and slowly eliminated and their action is in consequence prolonged. They differ further by producing sleep and affecting lightly almost solely the brain.

CHLORALHYDRATE ($CL_3 C H (O H)_2$) introduced by Liebreich in 1869, was the first hypnotic used besides morphine. It produces a sleep resembling the natural, without preceding excitement, the patient wakes up after a few hours refreshed, nausea, vomiting and headache following its use very rarely. But even when administered in therapeutic doses a slight effect upon the medullary centers can be noticed, the respiration and pulse are slower than usual and blood pressure and temperature drop slightly, of little consequence in the healthy, but of great importance in the sick. Chloralhydrate is contraindicated in the diseases of the heart and lungs, in anemia and in severe febrile diseases, in any disease that affects the circulatory or respiratory organs. Locally it acts irritating and caustic and cannot be used in gastro intestinal inflammations; continued use requires larger doses to be effective and gives rise to a chronic intoxication. It is used in gastrointestinal disturbances, in various skin eruptions, in mental and physical weakness, in asthmatic attacks and in psychoses. It is of great value as a hypnotic, if worry and nervousness is the cause of sleeplessness. It does not stop pain and is therefore useless when this keeps the patients awake. As antispasmodic, it is used successfully in tetanus, in strychnine poison, in infantile convulsions, in eclampsia and similar affections.

CHLORALFORMAMIDE, a combination of chloral and formamide has been produced to counteract the depressing effect of Chloral, by adding a stimulating amidogroup. The result has not come up to expectations, though chloralformamide is less toxic than chloral and does seem to have little cumulative action.

The indications for its use are the same as those for chloral. It is safer but not as prompt as this.



produces sleep without preceding excitement. It does not irritate the mucous membranes, does not cause constipation, does not need to be given in increased doses when repeated and does not affect the respiration, or the circulation. It is slowly absorbed and slowly excreted, but does not cause sleep till one or two hours after its administration. Continued use, even of small doses, causes chronic intoxication, nausea and vomiting, colicky pains and diarrhoea, or constipation, mental and physical weakness, ataxia and paresis, or paralysis of extremities, or of groups of muscles, and finally collapse symptoms. An early sign of intoxication is the red color of the urine, which becomes less in quantity and turns dark red, due to the formation of hematrophyrine. Death, especially when decided urinary symptoms have appeared, is frequent. Sulfonal should not be given for more than one week at a time. If toxic symptoms are noticed, its use has to be discontinued at once, the bowels thoroughly emptied and water freely given by mouth and by hypodermoclysis to dilute the poison.

TRIONAL—*Methyl sulfonal*—acts like sulfonal. It is more easily absorbed and excreted and produces sleep more rapidly. It is slightly less toxic than sulfonal and the indications for its use are the same as for sulphonal.

URETHANE ETHYL CARBONATE. The stimulating carbonic radical counteracts the depressing effect of the ethyl-group and even in large doses it affects the circulation but little. It is safer but less certain in its action than the other hypnotics.

“VERONAL”—DIETHYL BARBITURIC ACID—contains nitrogen and is related to urethane. It may be considered the best of these modern hypnotics. It does not affect the respiration and circulation in therapeutic doses, does not irritate the mucous membranes, does not disturb digestion and produces a dreamless quiet sleep usually within half an hour after its administration. The larger part is excreted, unchanged by the kidneys, but as elimination is slow, it may give rise to chronic intoxication by its accumulation in the system when used continuously. Toxic symptoms resemble those of sulfonal intoxication, loss of appetite, anemia, nausea and vomiting, constipation, dizziness and epilepti-

form attacks. I have seen, however, an active delirium, following a dose of five grains. Indications for its use are those of the other hypnotics.

ALCOHOL— $C_2 H_5 O H$ —the active ingredient of wine, beer, whiskey and other alcoholic beverages, is the product by fermentation of sugar in fruit juices and liquids that contain it. Its action upon the nervous system is that of the narcotics of the fatty acid series, paralyzing in turn brain, spine and medulla. Even in small doses, it has a paralyzing effect upon the higher intellectual centers, at the same time, stimulating the motor-centers. The effect of the cheering cup, characterized by a joyful, careless state of mind and a tendency to speak and commit impulsive acts without criticism is well known. The stimulation is due to an increased blood supply and partly to the paralyzing effect upon the intellectual centers permitting the motor centers to act without control. Small doses stimulate heart and respiration, dilate the vessels of the brain and of the skin, compensated by contraction of the splanchnics, so that blood pressure may rise. The widening of the vessels gives a full pulse and produces an agreeable sensation of warmth with increase of heat loss. Muscular work is decreased after the imbibition of alcohol, though the sense of fatigue is partly lost and work appears to be easier after its use. If given in moderate doses, it is burnt up in the system, replacing fat and carbohydrates, and saving proteids in the same proportion as these. Five per cent. is eliminated unchanged by lungs and kidneys, acting as a mild diuretic. On account of its action upon the nervous system, it cannot be used as food except when indicated in disease. The symptoms of acute intoxication are those of drunkenness, followed by death, due to respiratory paralysis.

Chronic alcoholism produces gastro intestinal and bronchial catarrhs, tremors, multiple neuritis, ataxia, physical degeneration, delirium tremens, arteriosclerosis, cirrhosis of the liver and degeneration of all organs and muscles.

For therapeutic purposes, alcohol is largely used locally as alcohol rub and as cataplasms, internally as stomachic to aid appetite and digestion, as food stuff in continued fever and in sepsis, in convalescence, in old age, and as a stimulant of the circulation and respiration. The dilatation of peripheral vessels and contraction of splanchnic is used to relieve internal congestion, and its mild narcotic action is useful in states of depression and convalescence.

When alcohol is to be prescribed, it must be borne in mind, that a habit is easily formed by some patients, and it is best, therefore, to disguise prescriptions, not to continue its use for any length of time, and to administer it with caution to those that are prone to form the habit.

SUBSTANCES THAT ACT UPON THE END FIBRES OF NERVES

THE VOLATILE OILS—aromatics—are found in a large number of plants. They contain terpenes and various aromatic compounds, to which they owe their aroma. Locally they act as irritants to skin and mucous membranes and when absorbed, as narcotic poisons. A number of them are used to correct odor and taste of other medical preparations, some as condiments and some are given on account of their antiseptic properties. Asafoetida and Valerian are used as nervines and the latter has acquired a reputation in the treatment of epilepsy.

The balsam of Cubeb and the Oil of Santal, rich in terpenes and resins, are excreted by kidneys and bronchi and are used in chronic inflammation of the genito urinary tract and in bronchitis. They act in a stimulating manner and are antiseptic. The whole mucous membrane of the genito-urinary tract is constantly bathed in an antiseptic urine during their administration. When given in large doses, they cause nausea, vomiting and diarrhoea.

THE BITTERS—stomachics, non-nitrogenous. Substances of vegetable origin and of bitter taste, act locally upon the mucous membrane of stomach and intestines. They improve the appetite, cause hyperemia and increase secretion and peristalsis. Immediately after their ingestion the gastro-intestinal secretions are decreased and not until they have left the stomach, about an hour after they have been taken, a re-action sets in and hypersecretion commences. They should be given some time before meals. They have been used as stomachics since time immemorial and are household remedies for indigestion today. Some are pure bitters, some contain mucilaginous substances, others volatile oils. Quassia, Gentian, Columbo, Hops, Vermouth and others, are daily prescribed to improve appetite and digestion. Condurango, which contains a bitter principle and two glucosoids, was long used in South America in the treatment of syphilis and malignant growth and after Friedreich's report of a case of carcinoma ventriculi cured with this remedy, was extensively tried in this

disease in Europe, mostly with negative results, though a number of observers reported favorably. I have used it in a number of cases with benefit in all, as far as improvement of appetite and digestion is concerned.

THE VEGETABLE PURGATIVES—They have been classified according to the intensity of their action and are called aperients, laxatives and drastics. All act irritatingly upon the mucous membrane of the intestines, increasing peristalsis, producing hyperemia and increased secretion. The effect of their administration is a more or less thorough and rapid semi-solid evacuation of the intestinal contents. The increased peristalsis prevents the thickening of the contents of the small intestines, as they pass rapidly through the colon. Some of these substances, like podophylin, aloe and senna, act, when given by hypodermic injection, but as they are excreted by the intestines, it is probable, that their action is local and by reflex, not differing from that when given by mouth. Most of them, especially the drastics, cause pain and inflammation when given in larger doses, due to the vigorous peristalsis they produce. Some have the reputation of increasing bile secretion; this has not been proven; others, do not act when bile is absent. Some increase the peristalsis of the whole intestinal tract and others affect the colon only. They are used as adjuvants in the treatment of chronic constipation. Those that act solely upon the large intestines are preferable for this purpose and change of remedy is necessary. Usually a number of these substances are combined and an addition of strychnine or belladonna increases their action. They are used to remove a fermentating mass of undigestible matter or of poison. Preparations that affect the whole tract should be given the preference in these cases. They are further used as derivatives to influence inflammation of distant organs and in the infectious diseases, to keep the bowels clean. The accompanying figures illustrate the action of a purgative on the circulation, which accounts for their favorable influence in these diseases. The decrease in size of the heart and liver can be seen.

(Figures 1, 2, 3).

Inflammation of the intestines and peritoneum, menstruation and hemorrhagia, contra-indicate their use. During pregnancy, in states of weakness and in old age, only the milder preparations should be used.

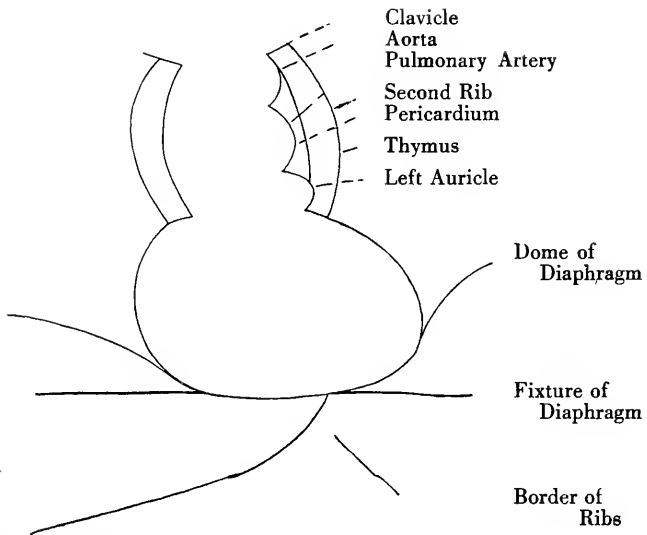


Figure 1—Dilated heart and vessels of a patient suffering from Obesity and Interstitial Nephritis. Fixture of Diaphragm. October 24, 1915, the patient was given on the 24th and 26th, three grains of calomel and soda, followed by a glass of Pluto in the morning.

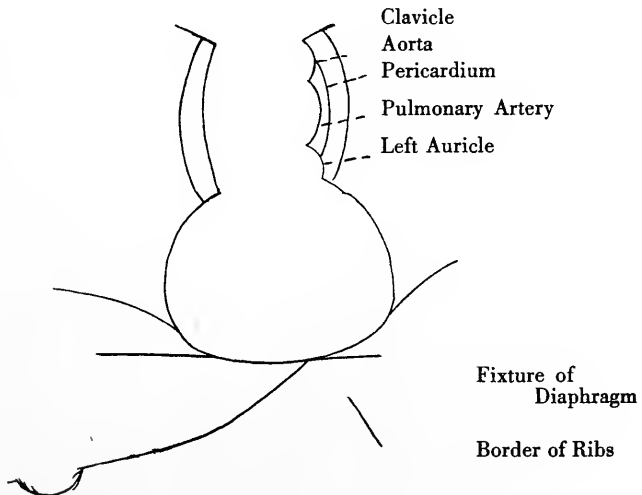


Figure 2—Same patient two days after second purgative.

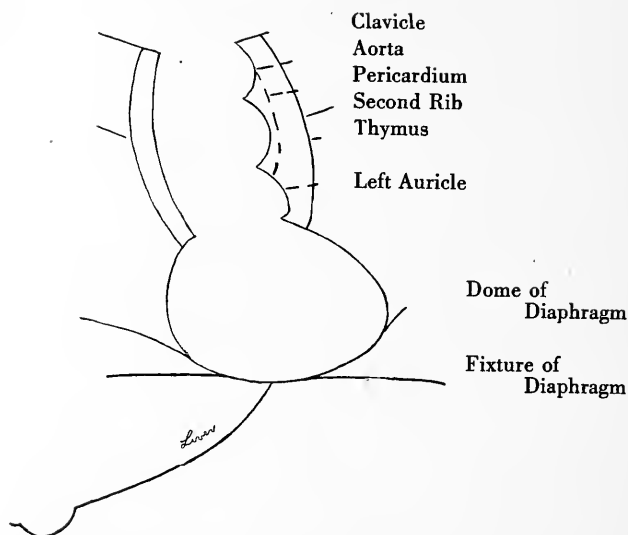


Figure 3 - Liver and Fixture of Diaphragm. Same patient six days after beginning treatment, and four days after taking second purgative. Lerch's Method of "Drop" Percussion.

CASTOR OIL is derived from the seeds of *Ricinus Communis*, a native tree of India, widely cultivated in the United States. It contains the glyceride of ricinoleic acid and ricine, a highly toxic ferment, which resembles the bacterial toxins. When ingested, the oil is decomposed by the pancreatic juice, setting free ricinoleic acid, which produces purgation by irritating the whole of the intestinal canal, the process of saponification commences as soon as the oil comes in contact with the pancreatic juice. It is one of the best and safest remedies to produce rapid and thorough evacuation, and is indicated whenever this is desirable. Continued use causes loss of appetite and indigestion.

CROTON OIL—derived from the seeds of *Croton Tiglium*, a native tree of India, contains the glycerites of several fatty acids and crotonoleic acid. It is highly irritating. It produces a pustular inflammation when rubbed into the skin, and a few drops ingested may cause a severe and fatal enteritis. It is rarely used for internal medication and only in cases of severe obstipation, and in uremia, after other means have failed.

THE ANTHRAQUINONE GROUP—Rhubarb, senna, aloes, cascara sagrada, frangula and others. The active substances of these vegetable laxatives are gradually set free in their

passage through the intestines and exert their action especially in the colon. They are all valuable remedies to relieve chronic constipation.

JALAP and PODOPHYLIN are rapidly acting drastic purgatives. They contain glycosoids and acid anhydrides as active principles. They increase peristalsis and secretion of the whole intestinal tract and cause blood and serous exudations in larger doses.

Jalap is frequently used to produce watery passages in edema and ascites and is generally followed by a saline laxative. Podophylin has the reputation of a cholagogue and is used in small doses in combination with other laxatives in chronic constipation.

COUNTER IRRITANTS—It was long known that internal morbid processes are favorably influenced by counter-irritation, produced by the stimulation of the endfibres of sensory nerves by reflex. They have been divided into rubifacients, that redden the skin and into vesicants that produce blisters. They cause a mild irritation of short duration of the surface of the vessels. A prolonged application produces widening of the vessels to a considerable depth, and a slowed respiration. An irritation of medium strength, stimulates the respiration and in states of collapse, a strong local application may cause return of consciousness. It has been shown that the hyperemia produced by these means is the curative factor. Their influence upon distant organs is due to reflexaction. They are used in inflammations of the serous membranes, in diseases of the lungs, especially in bronchitis and pneumonia, in arthritis, and in neuralgia and neuritis, to stop pain and effect a cure. Vesicants and pustulants are rarely used at present. Mustard, Oil of Turpentine, Cantharides, Antiphlogistine and other caoline pastes are the familiar substances usually employed as counter-irritants.

THE VEGETABLE ASTRINGENTS precipitate albumin from the tissues of the body, the alkaloids and the salts of heavy metals. They have been divided into two large groups, according to the blue or green precipitates they give from ferric salts. Applied to the mucous membranes they convert the surface cells into a dense, dry, pale and contracted layer, due to the precipitation and coagulation of albumin, the compression and contraction of blood vessels and the consequent diminution of glandular secretions. The secreting cells are changed just like the surface cells. Bacteria do not find a favorable soil to grow, under these

changed conditions. Astringents exert, therefore, antiseptic properties. If they are applied in concentrated solution, they penetrate deeper into the tissues and cause their destruction, they act then as caustics. Their action is purely local, and depends entirely on their property to precipitate albumin. They are valuable remedies in the treatment of chronic catarrhs of the mucous membranes of the nose and throat, of the intestines with diarrhoea, and in gonorrhoea, after the acute state has passed. Acute inflammations are aggravated by their application. They are used as antidotes in alkaloid poison; they form precipitates with these substances, which have to be removed by washing the stomach, by producing emesis, and by emptying the bowels, and they are employed to stop small hemorrhages.

Tannic Acid precipitating albumin in the stomach loses its therapeutic virtues, thereby, and is ineffective in intestinal affections. Tannigen, diacetyltannin, tannalbin are albuminous compounds of tannic acid and other similar preparations are not decomposed into the acid contents of the stomach, but become effective in the alkaline intestinal juice. They are used with advantage in sub-acute and chronic intestinal inflammations and diarrhoea of various origin.

DEMULCENTS—These are substances that form bland mucilaginous solutions, which act protectingly upon mucous membranes, as their natural secretion. They lessen normal and abnormal irritation of sensory nerve ends and decrease sensation of taste, temperature and of pain. Sugar tastes less sweet and acid less sour whenever given in such a solution and milk tastes less cold than water of the same temperature. If a 5% solution of Sodium Chloride is applied to a wound, it produces a severe pain, which is but little felt if a mucilaginous substance is added. They are used to correct the taste of sharp sour and irritating medical preparations, as emulsions in poisoning with acids and alkalies, to protect the mucous membrane, and for the same reason in catarrhs of the gastro-intestinal tract and of the throat. They lessen pain and peristalsis.

Acacia, Tragacanth, Slippery Elm, Starch, Flaxseed, Liquorice and others are all widely used.

EMOLLIENTS are bland fatty substances. They are for the skin what the demulcents are for the mucous membranes. They soften and protect it. Substances dissolved in fat pass

through the skin, and this method of medication is frequently used in the treatment of syphilis and in various diseases of childhood.

Lard, tallow, and olive oil, become easily rancid and irritating and it is, therefore, better to use lanolin (Woolfat) or vaseline, the residue of crude oil after distillation of the volatile, illuminating and lubricating oils. Neither of these fats turn rancid. Glycerine, a propenyl alcohol, manufactured by treating fats with superheated steam, is also extensively used, as an emollient. It is useful in the diseases of the skin. Fats are employed as ointments and liniments, or alone, to soften and to remove crusts and to make the skin pliable. Wax and tallow are better suited when the ointment is intended to remain for some time in place, and olive oil or fats with low melting point, when they are applied to make the skin pliable and soft.

MINERAL SALTS. The laws that govern the action of anorganic salts have been discussed in the beginning of this Chapter.

SODIUM CHLORIDE, common table salt, is used as an emetic, and to stop pulmonary hemorrhages. It is thought that the irritation of the vagus fibres of the stomach cause contraction of pulmonary capillaries. In collapse and after exhausting hemorrhages, it is used as physiologic salt solution or as Ringers Solution, which contains besides Sodium Chloride, Sodium Carbonate, Potassium Chloride and Calcium Chloride. It may be given intravenously, by hypodermic injections, or by clysis, to raise blood pressure and to replace loss of liquid. Mineral waters containing it are employed externally and internally in chronic catarrhs of the gastro intestinal tract, in chronic rheumatism, in gout, in chronic lymphatic affections and in the treatment of obesity. When salt is externally used, it must be borne in mind that crystalline substances do not pass through the skin, and when internally used, the osmotic pressure, the concentration of the water, and the specific action of other ingredients, if present in sufficient quantity, have to be considered.

Their curative effect upon patients at the watering places is partly due to the better hygienic surroundings and the use of other physiologic methods usually employed in combination with the bath treatment in these places.

THE SALINE PURGATIVE—A number of mineral salts attract water more than the cells of the body. The most important of these are Magnesium Sulphate, and the Sulphates, Phosphates, Tartrates and Citrates of Sodium and Potassium. This

property prevents absorption during their passage through the intestines, keeps the intestinal contents in a liquid condition and by slight local irritation increases peristalsis aided by the setting free of sulfuretted hydrogen. If given in large quantities they act as purgatives, but if administered in very diluted solutions and small doses, they are absorbed, excreted by the kidneys and act as diuretics. They are used therapeutically as laxatives and diuretics, magnesium sulphate in lead intoxication and as a remedy in tetanus by intravenous injections. It has a paralyzing effect; it suppresses convulsions, and is reported to cure. If these salts are given in concentrated solutions, they may be used to draw water from the system, though the disappearance of edemas after their use is partly due to a better circulatory condition and a better blood distribution.

The natural mineral waters of this character, like Karlsbad and Marienbad in Europe—Saratoga, French Lick and many others in the United States, are prescribed in gastro-intestinal catarrhs, in chronic constipation, and in diseases of the liver.

POTASSIUM AND SODIUM HYDROXID neutralize acids in soluble compounds with albumin, saponify fats, have a great affinity for water and on account of these properties, act as caustics by way of the hydroxyliones (OH) contained in their solutions.

Their caustic action is not limited by a dry scab, is severe and extensive. Taken internally in strong solution for suicidal purposes or by mistake, they cause severe pain in mouth, oesophagus and stomach, vomiting of bloody mucus and death. If only a small quantity has been taken, recovery with oesophageal strictures may follow. They are occasionally used as caustics, widely to saponify fats.

SOAPS, are salts of the alkalimetals with fatty acids. The sodium soaps are hard, the potassium soaps are soft. Their action is due to a small quantity of the alkali, which is set free in a large amount of water. It saponifies and dissolves the fat and tallow of the skin and opens the pores, macerates the upper layer of the epidermis and combined with rubbing and brushing, effects a thorough cleansing. They are largely used in the treatment of skin diseases, combined with mineral dusting powders or various medicaments. Internally they act as a readily procured antidote in acid poison, as emetic, when given in watery solutions. They increase peristalsis. A soapsud enema and soap suppositories are household remedies in constipation. Green soap incisions are employed in tubercular affections of skin and periton-eum.

THE CARBONATES of sodium and potassium neutralize acids and dissolve mucus. The acid carbonates are less irritating and preferably given for therapeutic purposes. They are rapidly absorbed, increase the alkalinity of the blood and in larger doses make the urine alkaline. Excreted by the kidneys, they act as diuretics.

The bicarbonates, or natural and artificial mineral waters that contain them, are used in the treatment of ulcers of the stomach in gastro-intestinal catarrhs and other conditions that produce hyperacidity, or a hypersecretion of mucus. It is used in diabetes mellitus, to treat the acidosis. In the uric acid diathesis, in the treatment of gravel and uric acid calculi, in cholecystitis and in chronic dry catarrhs of larynx and bronchi, the alkaline mineral waters are widely used and patients afflicted by these maladies crowd these watering places. The action of the waters is not fully understood in these conditions.

SULPHUR is inert, but when taken by mouth, it is partly converted into sulfuretted hydrogen, which increases peristalsis and produces semi-solid stools. Sulphuretted hydrogen is very toxic and inhaled in small quantities causes dizziness, shortness of breath and delirium. Death follows when the inhaled air contains from two to three per cent. and more, in a few seconds, or a comatose condition may precede convulsions, in which the patient dies. Its action is due to paralysis of brain and medullary centers. It is a germicide. Micro-organisms die in the sulfuretted hydrogen they produce.

CALCIUM SULPHIDE is, according to many observers, an internal antiseptic of great value. Waugh has called attention to the turgescence of the mucus membranes when the organism is under the influence of Calciumsulphide and believes its curative and analgesic action due its property to produce it. It has been highly recommended in diphtheria as adjuvant to the antitoxine treatment; the one acting as a germicidal, the other neutralizing toxins. It has been found useful in many other infectious diseases. In acute and chronic gonorrhoea and in gonorrheal arthritis, it is said to be an efficient remedy. It is frequently used to prevent pus formation, and causes its absorption, when the pus cannot be removed by surgery. The sulfides act locally as caustics and when absorbed, their action is that of sulfuretted hydrogen. Sulphur is used as a mild laxative and locally as ointment in skin diseases, to remove superfluous hair and

to treat scabies. The mineral waters that contain it, have a reputation in rheumatism, neuralgias and in chronic syphilitic affections.

AMMONIAC is a colorless highly irritant gas, soluble in water forming ammonium hydroxide NH_4OH . The solution is caustic; it contains hydroxylions when diluted and is irritating to skin and mucous membranes. It stimulates medullary centers and causes tetanic convulsions in lower animals. The respiration, after momentary stopping, becomes frequent and blood pressure drops, to rise again after a few seconds. If ingested in toxic doses, it produces a severe gastroenteritis with vomiting of bloody mucus and collapse and the simultaneous inhalation of the gas causes edema of the glottis, capillary bronchitis and hypostatic pneumonia. In therapeutic doses it acts as a cardiac and respiratory stimulant, increases secretions and liquifies sticky mucus. It is used locally as a stimulating ingredient of various liniments, and for inhalation in collapse and fainting spells, to stimulate the respiration by reflex from the mucous membranes of the nose.

AMMONIUM MURIATE is used in cough mixtures to liquify mucus, in catarrhal jaundice, in chronic hepatitis and as a prevention of tropical abscess of the liver.

AMMONIUM CARBONATE is used as a respiratory stimulant in bronchial affections. Ammonium compounds are rapidly absorbed and excreted as urea, which has been introduced as a diuretic and uric acid solvent.

PIPERAZIN an ammonium derivative, ethylendiamin, has been used for the same purpose. It dissolves uric acid in vitro. Clinical experiments have not borne out the claims made for it. It seems to lose its property to dissolve uric acid within the organism.

THIOSINIAMIN is employed to dissolve scar tissue. It acts by causing an immigration of leucocytes into the scar tissue and by saturating it with serum. With this preparation, I have treated very successfully scars in various locations, and especially a case of the pitting of the face of a lady thirty-five years of age, who had contracted smallpox in infancy.

NITROUS OXIDE, is a colorless and inodorous gas. It was discovered by Priestley in 1776, and used by Wells, an American dentist, as an anesthetic. It produces anesthesia within a minute, but for very short duration. It is now widely

used to commence an ether or chloroform narcosis. A beginning cyanosis is the sign that analgesia is complete, reflexes remain. Death is due to asphyxia—one in one million, according to Wood—the gas is not dissociated in the blood, oxygen is firmly bound to nitrogen.

THE NITRITES—Amylnitrite, and Sodium and Potassium Nitrite. A few drops, three to five of amylnitrite inhaled, causes flushing of the face, beating of the carotids and a sensation of fullness and heat in the head, which lasts a few minutes. This effect is produced by widening of the vessels, especially of the peripheral vessels, due to paralysis of the vasomotor center and to direct action upon the vessel walls. Blood pressure drops and pulse frequency is increased, due to paralysis of the vagus. Larger doses cause the formation of methaemoglobin. The action of sodium and potassium nitrite is the same, though slower. They are less rapidly absorbed; the effect is more prolonged, lasting from half an hour to one hour.

NITROGLYCERINE $C_2 H_5 (NO_3)_3$, a nitrate—it is partly reduced in the system to a nitrite and acts like these.

The nitrites are used in all conditions that are relieved by dilatation of vessels: in Bright's disease to reduce blood pressure; in migraine, when the skin is pale and cold; in angina pectoris; in epilepsy, with an aura to abort the attack, and to produce diaphoresis. Though the action is short, the effect is more or less prolonged. It seems that the vessels once dilated, do not contract as firmly as before.

CALCIUM is a necessary constituent of every cell and is found in large quantities in bones and teeth. It is important for many functions of the body. Muscles do not contract if deprived of calcium salts and the isolated frog heart ceases to beat when normal salt solution is passed through it, but commences again to beat on the addition of a calcium salt to the solution. Calcium salts act like digitalis upon the heart, increase the coagulability of the blood and labferment coagulates milk only in the presence of these salts. They are slowly absorbed and largely excreted by the intestines, only when larger doses are administered. Small quantities are found in the urine. Some of the calcium salts act caustically when locally used, their action is superficial.

BARIUM, though very closely related to calcium, is very toxic. Strontium is not. Both act like digitalis upon the heart. Calcined lime is used as cheap disinfectant in war and epidemics,

a solution of one to four thousand kills cholera and typhoid bacilli, and a combination of lime water and linseed oil (Carron Oil) is employed in burns and scalds.

LIME WATER given by mouth acts as an antiacid and astringent and is an efficient remedy in diarrhoea and sour stomach. Milk and lime water is popular in these conditions. The mixture can frequently be retained when all other food is rejected.

CALCIUM CHLORIDE is used as a heart tonic, in internal hemorrhages to increase the coagulability of the blood, and in pulmonary tuberculosis to favor calcareous degeneration of tubercular deposits. Calciumcarbonate administered by mouth for a long time, is a valuable remedy in the uric acid diathesis, to prevent the formation of gravel and calculi.

ACIDS—Their solutions contain positive hydrogen ions and negative acid Iones. They taste and react sour, form salts with alkalies, attract water, precipitate albumin, have antiseptic properties in concentrations of from 0.2 to 0.5% and they are excreted by the urine as normal or acid salts. Taken in concentrated solutions, they cauterize the mucous membrane of the gastro-intestinal tract, cause intense pain and vomiting of the sour contents of the stomach, and later of pieces of its membrane. Death is due to perforation, or to cardiac paralysis and dilatation of the splanchnic vessels, which produces lowering of blood pressure. Hemorrhages, nephritis, strictures and atrophy of the glands of the stomach may follow in case the patient survives the acute attack.

TRICHLORACETIC ACID, lactic acid and fuming nitric acid are occasionally used as caustics.

HYDROCHLORIC ACID, a normal constituent of the gastric juice is used in anacid gastritis, to act as a stimulant upon the glands and in hyperchloridia, when the acidity is due to fermentation. The fruit acids furnish refreshing drinks to fever patients, ablution with vinegar decreases sweat secretion and by evaporating, acts coolingly and refreshingly. Poisoning with a caustic alkali is to be treated with a diluted acid.

BORIC ACID— $H_3 B O_3$ has mild antiseptic properties and is little irritating. It is largely employed as a dusting powder, as an ointment and as a lotion. Borax of alkaline reaction, and similar antiseptic properties, is often used instead of the acid.

CARBONDIOXIDE (carbonic acid) is a colorless and odorless gas, is converted by pressure into a liquid, which on removing pressure is partly changed into solid white flakes. Its watery solution gives an acid reaction.

Carbonic acid is highly antiseptic. Applied to the skin and mucous membrane, it causes hyperemia and anesthesia, with preceding prickling and burning sensation. If taken internally, it quenches thirst, acts as a mild stimulant to heart and respiration, increases peristalsis and intestinal secretion. Inhaled, it is toxic—an irrespirable gas—and causes dizziness, headache, depression and, in large quantities, coma, convulsions and death. It is widely used. Some of the mineral waters contain it and are greatly valued for their refreshing qualities in fevers. Carbonated water alone and with fruit juice added are artificially prepared for the same purpose. The carbondioxide bath has become a valuable remedy in the treatment of heart disease and the acid is locally used as a stimulant in chronic inflammations and in ulcers; as a local anesthetic in cancer. Carbondioxide snow is used to treat lupus, rodent ulcers, nevi and other skin affections.

THE HALOGENS, CHLORINE, an extremely irritating green, yellowish gas is used in form of Chlorinated Lime, which contains about 30% of available chlorine, as a cheap and very efficient disinfectant of excretions. On account of its bleaching qualities, its use is limited. Like Bromine and Iodine, it combines with hydrogen in the presence of water, setting oxygen free, which in the state of nascence, is a powerful oxydizer.

IODINE is used locally to produce hyperemia. Repeated applications of the tincture cause an erythematous inflammation and finally desquamation. It is a powerful germicide and is employed to prepare the skin for surgical operations and to treat lymphangitis, phlebitis, synovitis and many other local inflammations accessible to external applications.

IODOFORM, (C. H. I₃), a yellowish green powder of a penetrating disagreeable odor. If dusted upon wounds, it is slowly dissolved, setting iodine free, to which it owes its great antiseptic powers. It decreases wound secretions, stops capillary hemorrhages, and acts slightly analgesic by paralyzing nerve ends. Absorbed in larger quantities, it causes malaise and headache, followed by restlessness and delirium, the prognosis is grave in these cases, death usually follows. Autopsies show a wide spread fatty degeneration in all tissues of the body, especially in liver and kidneys. On appearance of suspicious symptoms, the dressing has to be removed at once and the wound thoroughly cleaned with warm water. An antidote is not known, the free use of water internally will aid elimination. Iodoform is used as a local

antiseptic of wounds, especially in tubercular joint affections and in soft chancre. Internally, it is given instead of the iodides and it is an efficient remedy in tuberculosis pulmonalis.

THE IODIDES OF POTASSIUM, SODIUM AND AMMONIUM, best administered in milk or buttermilk, are rapidly absorbed and excreted. The larger portion is found within forty-eight hours in the urine and the rest is kept for sometime in various organs, especially in the thyroid gland. They exert salt action and act by ions. It is of interest, that the larger part of iodine, is found in diseased tissues increasing their tendency to decomposition and diseased tissues increasing their tendency to decomposition and absorption. The symptoms of intoxication are running of eyes and nose, injected conjunctiva, edema of the eye lids, skin eruptions and headache. Some persons are affected by a single dose, large or small, others by continued use only others not at all. If the kidneys are affected, caution is indicated as the iodine may be entirely retained within the organism. Discontinuance of the remedy and the free use of water, causes a rapid cure of iodism. Iodine cachexia may be produced by long continued use of iodine medication, and is characterized by restlessness, insomnia, palpitation, frequent and irregular pulse and great emaciation. The symptoms correspond with those of Basedow's disease and are thought to be due to over stimulation of the thyroid by increased production of iodothyronin.

The iodides are used in secondary and tertiary syphilis, often with marvelous results, in goiter due to colloidal degeneration, in glandular affections, in dry catarrhs of the bronchi, in asthma and in arterio-sclerosis.

A number of preparations of iodine, in combination with fatty acids or albumin, have been put on the market by various manufacturers to replace the iodides. Most of them are slowly absorbed and slowly excreted and act, therefore, far less vigorously than iodide of potash.

BROMIDES—The bromides are found with the iodides in sea water, and act like the narcotics, depressingly on the central nervous system. If taken in sufficient doses they produce a feeling of general relaxation, rest and finally sleep. Reflexes are diminished, showing their effect upon the spinal centers. The narcotic action of the bromides is due to Bromo Iones, the various salts act alike. Therapeutic doses do not affect the heart. They are easily and rapidly absorbed in the gastro intestinal canal, but slowly excreted by the kidneys and every other channel of elim-

ination. When used for a longer period of time, they accumulate in the system and cause intoxication "Bromism" skin eruptions, conjunctivitis, bronchial catarrh and gastro intestinal affections with final emaciation, cachexia, loss of memory, apathy and sensory and motor disturbances. Chlorine is diminished in the system as bromine is retained. The bromides are used as sedatives, in epilepsy, in chorea minor and in convulsions of children, in seasickness and various states of excitation. In tetanus and eclampsia, they are often combined with chloral. In epilepsy, it is best to give one large dose, one drachm in a cup of valerian tea at night.

OXYGEN AND OXYDIZING AGENTS—The amount of oxygen contained in the air is amply sufficient to sustain life during health. Only one-fifth of the oxygen of the inhaled air is absorbed by the blood and one-half of this is used for oxidation in the cells during quiet breathing. The balance, is returned unchanged with the venous blood. This is different in disease, when the blood contains an excessive quantity of carbondioxide and when the hemoglobin is not saturated with oxygen. Oxygen inhalations are used in the diseases of the respiration and circulation.

HYDROGEN DIOXIDE— $H_2 O_2$ —a bleaching disinfectant and deodorant—is contained in very small quantities in the air and is sold in watery solutions. In contact with wounds, ulcers and mucous membranes, it sets oxygen free and acts disinfectingly, cleaning and as a haemostatic. It is used to disinfect and clean wounds, and as mouth wash. It cannot be used in closed cavities on account of its violent gas formation, though valuable for cleansing wound surfaces.

POTASSIUM CHLORATE— $K Cl O_3$. It destroys the red blood corpuscles when taken in small doses internally, converting hemoglobin into methemoglobin. It has mild antiseptic properties and is used as a mouth wash to prevent and to treat mercurial stomatitis. On account of its great toxicity caution is indicated.

PHOSPHOR. Only the yellow or white phosphor is active. The red amorphous modification is insoluble and nonvolatile. Phosphor in small doses stimulates the brain and circulation, the functions of the stomach and of the genital organs and especially the growth of bones, in children, though in the adult this influence is not entirely lost. Its fumes cause necrosis of the maxillary

bones, a secondary process, which is due to invasion of pus cocci after the decomposition of compact bony tissue. Large doses ingested for suicidal purposes, cause a feeling of heat and pain in the epigastrium with vomiting of the stomach contents and mucous, bloody diarrhoea.

After an interval of a few days of freedom of all symptoms, icterus, enlargement of the liver, continuous vomiting, severe abdominal pain, great nervous prostration, fever, hemorrhages from nose, intestines and uterus and heart weakness, coma, occasionally convulsions and death follow.

The urine contains bile, fat droplets, leucin and tyrosin, and post mortem findings show an abnormal amount of fat in the striated muscles, walls of the small arteries, kidneys and liver. An excessively large dose of phosphor may cause death in a few hours due to cardiac paralysis.

The local action of phosphor is slightly irritating. Phosphor oil rubbed into the skin, causes redness and burning. It is used in various nervous diseases, in rachitis and osteomalacia to stimulate bony growth. Instead of pure phosphor, calcium phosphate, the hypophosphites and recently organic preparations, Lecithin, phosphor albumin and other similar preparations are used.

ARSENIC. The most important preparations are arsenious acid (As_2O_3) and the organic arsenic compounds. Given in small doses to animals, it increases their weight, stimulates bony growth and beautifies the fur. It has a similar effect in man. A habit can be established and an individual commencing with small doses, may finally take quantities far exceeding a lethal dose. This is shown by the inhabitants of the Styrian Alps, who take arsenic to enable them to climb their mountains with greater ease and to increase their resistance. Symptoms of intoxication are not observed in them and they live to an old age. Cloetta has shown that this immunity is largely due to lessened absorption in the intestines.

Toxic doses cause, soon after ingestion, severe pain and burning in the esophagus, stomach and abdomen, dryness of throat and metallic taste with vomiting and purging. The stools are watery, and resemble with the other symptoms, scanty urine, cold extremities, cramps, excessive thirst, small and feeble pulse, rapid and labored respiration and cyanosis, an attack of cholera—death follows in coma or convulsions. If the patient survives, the symptoms become gradually less severe and skin affections make their appearance, urticaria, melanotic spots or vesicular papular and

pustular eruptions. The treatment consists in evacuation of the stomach and in the administration of a freshly prepared ferric hydroxide.

Chronic intoxication is characterized by gastro intestinal disturbances, redness of the eyes, injected conjunctivae edematous lids, prostration, irritation of temper, loss of memory, giddiness, paresthesias and partial anesthetics, neuralgic pains, symptoms of peripheral neuritis and skin affections, especially discolorations. An examination of the urine will make the diagnosis. The cause of intoxication has to be removed and the patients have to be treated symptomatically.

Arsenic in solution is rapidly absorbed and deposited in every organ of the body and mostly excreted by the kidneys. It dilates the capillaries, especially the splanchnic, depresses the nervous system, acts stimulatingly upon blood making organs, possesses specific germicidal properties in malaria, sleeping sickness and syphilis, caused by vegetable micro-organism, that seem closely related to animal microbes, and it acts locally as caustic. The organic arsenic compounds are less toxic than the anorganic compounds. Arsenic is not contained in their solutions as Iones and they possess, therefore, no germicidal effect in vitro, but acquire this property within the organism by gradual chemical decomposition.

ATOXYL paramido—phenyl—arsenic acid, has been the basis of Ehrlich's researches. It is little used at present; it may cause blindness by atrophy of the optic nerve.

SALVARSAN (Dioxydiamido arsenobenzol)—The discovery of Ehrlich has taken its place and has become a highly valued remedy in syphilis, though it is admitted that it must be given in conjunction with mercury and iodides in this disease.

CACODYLIC ACID has been used widely in the form of sodium cacodylate and is indicated whenever arsenic is needed. It shares the slight toxicity of the other organic compounds of arsenic and its hypodermic injections are painless.

Arsenic is used as specific in the infectious diseases mentioned, in all forms of anemia and leucaemia. In the chronic diseases of the lungs and nervous system, in malignant lymphoma and sarcoma, in wasting diseases and locally as a caustic in lupus and epithelioma and in dentistry to kill nerves.

I have given arsenic in all chronic affections that need stimulation, and have noticed in all a marked improvement, which could

not have been obtained by employing other means of treatment alone. In syphilis, I have used it as an adjuvant ever since I have practiced medicine and often obtained the most excellent results when mercury had failed.

In a case treated by me, eighteen years ago, a young man affected with an ulcer of the tongue, had been treated at Hot Springs with mercurial inunctions and the iodides for several years without results. Arsenic, at that time given by mouth, the hydrobromide in large doses, effected a prompt cure and he has been in good health ever since. Another case, six years ago, a patient who came with severe rheumatic pains in every joint, so severe that he could not walk; with large ulcerations of larynx, and with crescents upon the forehead, and who came after being thoroughly saturated with mercury and iodides without success, was rapidly cured with hyperdermic injections of cacodylate of soda.

THE HEAVY METALS act locally as astringents or caustics. They form precipitates of albuminates in contact with tissue albumin. If superficial, the action is astringent, if penetrating to some depth, it is caustic, depending upon the metal and the acid ions, on the concentration of the solution and on the affinity of the salt to water. Most metals act only as astringents—that is, they form a dense precipitate covering and protecting the underlying tissue. Some, however, are soluble in an excess of albumin and in a solution of sodium chloride and these penetrate and act as caustics. Diluted solutions may act as astringents, whereas, concentrated solutions may act as caustics, and a hygroscopic salt acts locally stronger than one that has no affinity to water. Iron acts solely as astringent and mercury when soluble, for instance, the bichloride, as a very vigorous caustic. All metals when absorbed are toxic, yet cases of acute poisoning are rare, because they are only absorbed in minute quantities in the gastro-intestinal canal, but they may give rise to chronic intoxication, when constantly absorbed and slowly eliminated. All are readily absorbed from wound surfaces. They paralyze the central nervous system, destroy red blood corpuscles, cause fatty degenerations of various organs, and peripheral vascular dilatation and inflammation of the gastro-intestinal canal. Their specific action depends upon the dissociation to metal ions within the organism. The organic compounds of the metals are slowly dissociated and exert slowly their specific action. Deposits are found in almost every organ, especially in liver, kidneys and spleen. They are excreted

with the bile, through the mucous membrane of the gastro-intestinal canal, and in minute quantities through the urine, saliva and milk. If given in a colloidal state, pseudo solution, which contains ultra microscopically small metal particles suspended, they act by catalysis, similar to the ferments. Intravenous injections into animals causes leucocytosis and rise of temperature and weakens the action of bacterial toxins.

ANTIMONY closely related to arsenic, was formerly widely used as a vesicant pustulant and as a powerful emetic. At present, it is only occasionally employed as expectorant in small doses, and in larger doses as emetic. Though its action is rapid and certain, it produces symptoms of collapse and has been mostly abandoned on that account.

MERCURY, a protoplasmic poison when in solutions, due to mercuric ions in them—is on that account a powerful disinfectant, irritant and caustic to skin and mucous membrane. Local applications redden the skin and when concentrated, produce inflammation, deep cauterization, and necrosis, when applied to open wounds. Taken internally, it causes severe pain, bloody vomiting and collapse, due to its vigorous caustic action upon the gastro-intestinal mucous membrane.

Small therapeutic doses act diuretically and toning, increase the number of red blood corpuscles and body weight. Such doses seem to stimulate the cells of the organism to greater activity. Acute intoxication, sometimes following a rapid absorption after an injection of nonsoluble salts, or after the use of bichloride of mercury solutions in operations, is characterized by bloody bowel evacuations, containing pieces of mucous membrane, by severe and continuous tenesmus, by small quantities of dark colored bloody urine containing albumin and kidney cells, by collapse symptoms and death, due to cardiac paralysis. Subacute poisoning after continued internal use of mercury, when elimination is less than absorption, is marked by stomatitis, swollen red gums, loose teeth, profuse salivation, dropping out of teeth, gangrene and necrosis. Intestinal and kidney affections, similar to those following an acute intoxication have been occasionally observed. Chronic intoxication, due to continuous absorption of minute quantities of mercury, attacks persons that work with the metal in mines, smelters and various trades in which it is used. In this form it affects especially the central nervous system causing irritable temper insomnia anxiety, tremor, depression, choreic move-

ments, convulsions, epileptiform attacks, pareses and parasthesias accompanied by inflammation of the mouth and by gastro-intestinal disturbances.

Therapeutic doses of insoluble salts are diuretic, antiseptic and laxative, due to the formation of non-toxic compounds, which prevent absorption of liquid in the small intestines and stimulate peristalsis. Calomel stools are of green color containing unchanged bile pigment. As vapor, mercury is readily absorbed by skin and lungs and so are its soluble compounds, whereas, its nonsoluble salts are only absorbed in minute quantities during their passage through the gastro-intestinal canal after ingestion. All form albuminates, soluble in excess of albumin and sodium-chloride solution; they are deposited in the kidneys, liver and in minute quantities in all other organs and tissues and they are mainly excreted by the intestines and kidneys, though they are found in all other secretions of the body.

Mercury acts as a specific in syphilis, probably curative; it destroys the spirochetes. This makes it one of the most valued remedies. The generally adopted plan for its employment in this disease, is an intermittent treatment after Fournier, extending over several years, to be continued until Wasserman's reaction remains negative. It is administered by inunctions, by injections of soluble and nonsoluble salts, by inhalation and by mouth. On account of its great toxicity, and its property to form albuminates, it is at present less employed for antiseptic purposes than formerly, though it is still largely used externally in the treatment of parasitic infections of the skin. Calomel is frequently used as a mild and thorough laxative and intestinal antiseptic in a number of infectious diseases. Its action as a cholagogue is questioned.* As diuretic, it is occasionally used when other means fail. In acute intoxications, milk and tannin has to be administered and the stomach emptied, best by lavage. Salivation can be prevented by cautious use and thorough mouth hygiene.

IRON is a necessary ingredient of all organic life, and is found everywhere in Nature. In plants, it forms chlorophyl, and in animals, it is found in every cell, especially in the red blood corpuscles. Its salts act astringently and caustically, they have a peculiar inky taste, blacken the teeth, cause dyspepsia and constipation and in large doses gastro enteritis. They stop bleeding by forming a dense scab of albuminates.

It has been experimentally proven that iron and its salts are converted into chlorides by the gastric juice and later into soluble

*Calomel affects the whole intestinal tract, and mechanically, by traction empties gall bladder and liver.

albuminates, which pass through the lining of the epithelial cells into the lymphatics, and excreted by the lower intestines. Iron increases the amount of haemoglobin of the red blood corpuscles, and is used whenever this is deficient, chiefly in chlorosis; it is less successful in other forms of anemia; it is used as an antidote in arsenic poison and externally as hemostatic. A larger number of iron preparations are recommended. The organic compounds though not more easily absorbed than the inorganic compounds are sometimes given the preference, because they are less irritating and astringent, they have their affinity to albumin satisfied.

MANGANESE, when subcutaneously or intravenously injected is very toxic and is eliminated largely by the intestines, only traces pass through the kidneys. Experiments with animals by feeding them with noncaustic preparations have given no results. It is absorbed in minute quantities in the gastro-intestinal canal and rapidly eliminated.

Potassium permanganate is a powerful oxydizing agent, antiseptic, disinfectant and deodorant. If ingested in concentrated solution, it may cause severe gastro-enteritis. For therapeutic purposes, it is best given in pill form or capsule and is praised as a remedy in amenorrhoea and in flatulency. Diluted solutions are employed for antiseptic and deodorizing purposes, as wash for wounds and ulcers, and concentrated solutions, injected around a snakebite, are reported to destroy the poison. It is an antidote in morphine poison by deoxidizing it and manganese salts in combination with iron are administered in the anemias and chlorosis. The dioxide is useful in the treatment of hyperchloridia, pyrosis and the derangement of the menstrual function.

SILVER is chiefly used as silver nitrate, and in form of organic compounds, as an astringent, caustic and antiseptic. A solution of silver nitrate precipitates albumin as a white albuminate, which turns gray on exposure to light, due to decomposition; the metal and its oxide is set free. The same process takes place when silver nitrate comes in contact with the skin, mucous membranes and wounds. It acts as an astringent in diluted solutions and as a strong superficial caustic in concentrated solutions. The firm scab of silver albuminate protects the underlying tissue. In a solution of 1:1000 it kills staphylococci, streptococci and anthrax bacilli, and prevents their development in blood serum in a dilution of 1:80,000. When given internally, it is slowly absorbed by the gastro-intestinal canal, and when administered for a long

time, produces argyria, a deposition of silver in the skin, turning it dark; in the mucous membrane of the mouth it forms a blue line around the teeth, similar to the well known leadline. It is deposited in the liver, spleen and in all other organs and tissues of the body. It has no systemic effect upon the organism in man; when administered by mouth, when subcutaneously or intravenously injected into animals, it paralyzes the central nervous system, causing death by respiratory paralysis. It is used as an astringent and caustic in affections of the skin, and mucous membranes. The eyes of new born babies are disinfected with a few drops of nitrate of silver solution to prevent ophthalmia neonatorum, formerly the most frequent cause of blindness. In gonorrhoea, cystitis, in chronic inflammation of the stomach and in *ulcus ventriculi*, it is an efficient remedy. Its internal use for nervous diseases has been almost completely abandoned. Of the modern preparations, protargol, a soluble albuminate, and colloidal silver are the most important. Subcutaneous and intravenous injections of this latter preparation and inunction with Credé's ointment are used in septicemia and in various other infectious diseases. They have given good results in the hands of some observers and are questioned by others.

COPPER—The salts of copper act in diluted solutions as astringents; as caustic and emetic, when concentrated, they kill the lower forms of life; typhoid bacilli in a dilution of from 1:1,000,000 within three hours, though other bacteria are more resistant. Large doses produce vomiting and a severe gastroenteritis, and in some cases, paralysis, delirium and convulsions. Chronic intoxications are not known. Copper sulphate is used as astringent and caustic, and copper compounds in minute doses are employed as intestinal antiseptics in bowel affections.

Potassium ferrocyanide is the antidote and white of egg and milk and other albuminous matter will precipitate the copper and make it inert. The stomach has to be emptied and washed.

LEAD—The salts of lead act as astringents and form a firm white precipitate with albumin in contact with mucous membranes and wounds. Given by mouth, they are slowly absorbed in their passage through the gastro intestinal canal and accumulate in the system. Slowly eliminated by kidneys and intestines, they sooner or later cause symptoms of chronic intoxication; loss of appetite, general malaise, constipation, loss of weight and anemia. The red blood corpuscles contain granules that can be stained with basic dyes, a blue line forms around the teeth consisting of particles of

lead sulphide, deposited in the gums, colics, most severely felt around the navel and radiating in every direction accompany the attack. The abdomen is contracted, the pulse full and slow, pain is felt in every joint and paralysis begins in the wrists and forearms, gradually affecting the upper arms and shoulders. Severe headaches and epileptiform attacks that may cause death are occasionally seen, and chronic nephritis, resembling an interstitial nephritis is not a rare sequel of chronic lead intoxication. The attacks have intermissions of apparently good health.

The internal use of lead preparations for therapeutic purposes has been almost completely abandoned; they are valued as efficient astringents and freely used in the treatment of bed sores, contusions and wounds, in gonorrhoea, vaginitis and in diseases of the skin. The most favored preparation is the subacetate of lead in solution. It acts cooling and astringent, but should not be used in inflammation of the eye, as the cornea may be impregnated with insoluble lead salts. Acute intoxications are rare and have to be treated with stomach lavage, and the administration of albuminous substances. Chronic intoxications have to be treated by at once removing the source and with laxatives, and with Potassium Iodide to favor elimination.

ZINC salts act astringently and caustically, depending on the acid with which the metal is combined and on the concentration of the solution. Ingested in large doses, they cauterize the mucous membranes. Symptoms due to absorption and chronic intoxication are not known. Injection of soluble double salts subcutaneously or intravenously into animals causes ascending spinal paralysis and paralysis of striated muscular fibres.

ZINC SULPHATE is a much valued astringent in the treatment of skin diseases, in gonorrhoea and conjunctivitis, after the acute stage has passed.

ZINC OXIDE is used in form of a dusting powder, as mild antiseptic, and zinc chloride, as a strong and penetrating caustic.

The internal use of zinc salts formerly largely employed as sedative in nervous diseases has been abandoned.

BISMUTH—The most frequently used of all its salts is the subnitrate. Dusted upon wounds, it acts mechanically, protecting, astringent and antiseptic and given internally it slows peristalsis. It forms the sulphide which prevents the formation of sulphuretted hydrogen, the stimulant of intestinal peristalsis, and colors the feces black. On account of its protecting property, it is a

most valuable remedy in ulcer of the stomach; it covers the surface of the ulcer like a scab. It has to be given in large doses and upon an empty stomach. For diagnostic purposes in Roentgen ray practice, the carbonate is used, mixed with mush. The carbonate of bismuth is preferred, as large doses of the subnitrate have caused severe intoxications, resembling nitrate poisoning. Of the large number of bismuth compounds recently introduced, the salicilate of bismuth is of greater antiseptic power. The subgallate, known as dermatol, and bismuth tri-bromphenol-xeroform—a substitute for iodoform, are the most important.

ALUMINUM, Alumn, is its most important salt and, in solution, is used locally as astringent in chronic catarrhs of the **mucous membranes of the mouth, throat and vagina**, and as escharotic. It is a useful dusting powder upon wounds to produce healthy granulations. It is a non-depressant emetic and an antidote in lead poisoning. Large doses ingested may produce a severe gastro enteritis. Chronic intoxications are not known.

CHROM, Chromictrioxide is a powerful and penetrating escharotic and is used with sufficient water to make a paste, or in a concentrated solution. The surrounding tissue has to be protected by cotton, saturated with a concentrated alkaline solution. It sets oxygen free and acts as a vigorous oxydizer. Chromic sulphate has been highly recommended in the treatment of goiter, locomotor ataxia, and prostatic enlargement.

THE ANTISEPTICS—Since modern researches have shown that not alone wound diseases, but also a large number of internal diseases are caused by micro-organisms, antiseptics have become of great importance. They furnish effective means for causative treatment: (1) This may be prophylactic, that is, to protect from infections. (2) To change the composition of the fluids in which the micro-organisms grow; to make their development impossible. (3) To neutralize the toxins, which they produce. (4) To kill the pathogenic microbes, mostly bacteria. Those chemical compounds that by their presence prevent development and growth of the micro-organisms, by paralyzing them, are usually called antiseptics, whereas those that kill, are called disinfectants or germicides. It has been frequently observed that the presence of minute quantities of these therapeutic agents, act in a stimulating manner upon the microbes and that, therefore, in a number of instances, at least, an insufficient application of an antiseptic is worse than none at all. Antiseptics may be divided into two large

classes; those that possess strong chemical affinity to albuminous substances and act tonically, destructively, escharotically, as the halogenes, oxidizers, acids, alkalies and metallic salts; and those that act by molecular chemical processes in a specific way, as specific protoplasmic poisons. Those have to be selected which act as an antiseptic and disinfectant upon the microbes, without damaging the host, that is, those that possess greater affinity for the microbes, than they have for the protoplasm of the body. So far, no substance is known that acts ideally, as the concentration in which they are active, damages both, parasite and host in all cases, especially the central nervous system and the organs of excretion. Surgeons prefer, therefore, an aseptic treatment, and use antiseptic applications only in infected wounds. In these cases absorption is slight and the danger of general intoxication small, unless large surfaces have to be treated, when this possibility has to be considered. In the treatment of the gastro intestinal canal, substances have to be selected that are difficult to dissolve and difficult to absorb and those give the best results, that by chemical decomposition during their passage through the tract, develop antiseptic and disinfectant properties.

A general disinfection of the whole organism is, therefore, difficult, and so far next to impossible, though a few substances are known which act as antiseptic and disinfectant in a few infectious diseases and but slightly damage the system. That is, they possess greater affinity for the microbes though fixed also by the cells of the organism and, therefore, toxic. Such substances are rare, and large numbers of experiments made with the various strong antiseptics and disinfectants in the infectious diseases have all proven failures. They damage the microbes no more than they do the host, with the exception of diseases that are caused by plasmodia, trypanosomes spirilli and spirochoetes; quinine in malaria, mercury in syphilis, and arsenic in both diseases have been known and used for centuries. Researches during recent years have produced organic arsenic compounds that are less toxic to the organism, and these have proved effective in syphilis and sleeping sickness. Atoxyl, was made the basis by Ehrlich for his experiments, extending over several years, to find atoms or atom-groups within the molecule which increasing the affinity for the parasites and decreasing it for the cells of the organism, lessen its toxicity. The discovery of salvarsan has been the result, which changed within the organism, produces compounds that act specifically on spirilli and spirochoetes. Salvarsan does not act *in vitro*. It is a

specific in syphilis, sleeping sickness and recurrent fever. This, as well as quinine and some of the antiseptics and disinfectants, belonging to the first class, and some belonging to the second class, have been discussed in previous pages on account of other properties they possess.

The compounds of the Aromatic Series act antiseptically, antipyretically, finally paralyzingly upon the nervous system, they are typical protoplasmic poisons when in solution, and soluble in fats. Their antiseptic properties are probably due to their solubility in the lipid tissue of the bacteria, allowing them to enter into the cells and to destroy them. All are excreted by the urine.

NAPHTHALENE is a benzene derivative formed by the condensation of two benzene rings. It is found in coal tar in large quantities. When taken internally it is slowly and only in minute quantities absorbed by the intestines and excreted by the kidneys. Larger doses may cause pain, tenesmus, dark colored urine and albuminuria. It is used as intestinal antiseptic.

CARBOLIC ACID—(C_6H_5OH) phenol, possesses stronger affinity to protozoa than to bacteria and acts more vigorously on the vegetating forms than upon spores. It is a strong astringent escharotic and mild anesthetic. In very diluted solutions,—1%-2% it loses its cauterizing property, though this concentration is still antiseptic and is used to disinfect wounds. An addition of oil makes it useless for antiseptic purposes, whereas, an addition of sodium chloride increases the antiseptic proportions by making it less soluble in water. Carbolic acid is easily absorbed by wounds, skin, and by mucous and serous membranes.

Large doses increase the respiration and cause convulsions, followed by paralysis of the brain and spinal centers. It is eliminated by the kidneys, chiefly as glucuronic and sulphuric acids. The urine has a smoky appearance, due to oxidation compounds. It is used as gastro intestinal antiseptic, for its anesthetic properties and as local antiseptic in the treatment of wounds and sores.

When phenol is taken for suicidal purposes, which is often the case on account of the facility with which it can be obtained, the diagnosis is usually easy to make. The odor is characteristic, the mucous membranes of mouth and throat show white patches, and the urine is of a greenish smoky color. The stomach should be washed with diluted alcohol,—phenol solvent—followed by washing with water to remove all traces of the poison.

Sulphates are used as antidotes, though some doubt has been thrown on their efficacy by recent investigations, symptomatic treatment has to be instituted and demulcents are given to protect the wounded surfaces.

CRESOL is a mixture of ortho-meta and paracresol, it is a yellowish colored liquid with phenol odor, soluble in water, alcohol and glycerine. Cresol is soluble in 60 parts of water and its solubility is increased by the addition of alkaline soap. One of the hydrogen atoms of phenol (C_6H_5OH) is taken by a methyl group, and as this is possible in three places within the molecule the three isomeric compounds are derived. This substitution increases the antiseptic power, and decreases the toxicity of the compound, it acts less escharotic upon the skin than carbolic acid. It is an antiseptic and disinfectant. Creolin and Lysol at one time widely employed are mixtures of cresol and soaps and the liquor cresoli saponatus is practically the same. These preparations give fine emulsions with water. Creosote, a mixture of various phenoles, including guajacol is internally used in the diseases of the lungs and bronchi; it increases appetite and lessens cough and expectoration, but it is impossible to give it in concentrations sufficient to act germicidally upon tubercle bacilli.

THYMOL—para-propyl-meta cresol—is of greater antiseptic powers than cresol, and it is far less toxic. Its little solubility in water, makes it a good intestinal antiseptic and anthelmintic. It is found in the oils of thyme and various other plants and is largely used in hookworm disease.

RESORCIN—a dioxibenzol—consists of colorless plates, turning reddish on exposure to the air, it is soluble in water, alcohol and ether, of antiseptic strength like phenol, but less toxic and is especially used in the treatment of skin diseases.

Pyrochatechin and hydrochinone 2 oxybenzols are therapeutically little used.

PYROGALLOL—is a trioxybenzol, easily soluble in water, a powerful reducing agent, used in the treatment of lupus and psoriasis. Absorbed, it paralyses the central nervous system and causes formation of methemoglobin. Caution is necessary when larger surfaces are treated.

CHRYSAROBIN—a constituent of Goa powder is found in the hollow of Andira Ararobo, a tree growing in Brazil. It is closely related to pyrogallol and like this substance, especially in the presence of alkalies, it is a powerful reducing agent. It is

absorbed by the skin and excreted by the kidneys and the urine turns red on addition of potassium hydroxid or ammonia. It is the best remedy in the treatment of psoriasis, though it does not prevent recidives. It is also used in other parasitic skin affections.

ALPHA NAPHTHOL and BETA NAPHTHOL consist of white crystal laminae of phenol odor, soluble in alkalies, fats and alcohol, derived from naphthaline by substitution of a hydrogen atom through a hydroxylgroup. According to the position of this group within the molecule Alpha or Beta Naphthol are produced. The former cannot be used on account of its great toxicity. Beta Naphthol is used in the treatment of skin diseases and as gastro intestinal antiseptic. It is absorbed by skin and mucous membranes, and excreted by the kidneys and frequent examinations of the urine are necessary. The remedy must be withdrawn as soon as albumin appears.

TAR is essentially a mixture of phenols and is used as syrup in bronchial affections and locally in the treatment of skin diseases, in form of soaps and ointments.

ICHTHYOL is prepared by distillation of bituminous rocks of Tyrol which contain fossil fishes, it is of a tarry odor and appearance, soluble in water and in a mixture of alcohol and ether. It contains a large percentage of sulphur and is locally used in gynocological practice, in erysipelas and various skin diseases. Internally as intestinal antiseptic.

BENZOIC ACID consists of white feathery crystals, its ammonium and sodium salts are freely soluble in water, the acid is almost insoluble. It is found in many plants and is a characteristic constituent of various balsams, in which it occurs with cinnamic acid closely related to benzoic acid. It is less toxic than phenol and possesses greater antiseptic powers. It is used in uremia, as expectorant and in articular rheumatism.

PERU BALSAM AND TOLUBALSAM contain both benzoic acid and a large percentage of cinnamic acid. They are used as expectorants. Peru balsam is also used as antiparasitic remedy, especially in scabies and to stimulate granulations of torpid ulcers.

SALICYLIC ACID was formerly manufactured from the willow bark, or from oil of wintergreen, at present almost solely from phenol. The acid, a white powder, is sparingly soluble in water, its sodium and potassium salts are readily soluble, it is a strong antiseptic, far less so its salts. In contact with the skin,

it dissolves its epithelial cells without pain and acts irritatingly on mucous membranes. Injected it is converted into and absorbed as sodium salicylate. Large doses cause a sensation of heat, perspiration, fullness in the head, roaring in the ears and deafness, due to injection of the vessels of the drum. This can be prevented like cinchonism by the administration of the bromides. Toxic doses cause delirium, drop of temperature, slowed respiration, cardiac weakness, convulsions and death due to respiratory paralysis. It is also an antipyretic, and its action is similar to antipyrine. It increases the output of urea and uric acid by the urine, acts slightly diuretic and is one of the best cholagogues. It is absorbed by skin and mucous membranes and partially unchanged, excreted by the kidneys. An addition of ferricchloride to the urine, produces a dark violet color.

It is almost a specific in acute articular rheumatism. It lowers temperature, stops pain, lessens the joint inflammations and shortens the duration of the attack. It has no influence on the cardiac affections accompanying acute inflammatory rheumatism. Tonsillitis, that usually preceeds this affection has to be treated at once with the salicylates. The many *so-called* rheumatic affections are all favorably influenced, though the action of these conditions is mostly symptomatic and analgesic. In diseases of the liver, it is used as a cholagogue and in rheumatic serous pleutiris, it causes absorption. Locally it is used in form of powder, as ointment or in solution as antiseptic in the diseases of the skin.

SALOL is a white tasteless crystalline powder. It is only decomposed in an alkaline medium and passes the stomach unchanged, it is used as intestinal antiseptic, and as antiseptic of the urinary tract. It breaks up into phenol and salicylic acid in the intestines, but on account of its large percentage of the former, it can be only administered in small doses.

ASPIRIN—Acetyl salicylic acid, is less irritating to the mucous membrane of the stomach than the acid and the sodium salt and possesses greater antipyretic and analgesic properties than this and is, therefore, given in preference. A number of similar preparations are now on the market.

FORMALDEHYDE is a gaseous substance of strongly pungent odor, very irritating to the respiratory tract, coagulates albumin in concentrated solutions, but prevents coagulation when very much diluted. It is readily absorbed, and excreted by the kidneys unchanged. It is a more active antiseptic when in the

gaseous state than when in solution and air containing 2% of the vapor rapidly and completely disinfects all surfaces. The presence of moisture is necessary to produce this effect. It is used for the disinfection of rooms and generated in lamps constructed for this purpose.

HEXAMETHYLENAMINE—tetramine—urotropine—is a combination of formaldehyde and ammonia. It is used as a urinary antiseptic. Its action is due to a slow liberation of formaldehyde in the urine. Its continued use, if given in large doses, may cause severe irritations of bladder and kidneys. More recently it has been employed in infections of the spinal cord, having been found in the spinal fluid.

THE ANTHELMINTICS, agents that kill and expel intestinal worms, without affecting the host. Those in use are generally muscular poisons. They paralyze the worms, which are then expelled by vigorous peristalsis. The alimentary canal has to be emptied to allow the drug to act and the administration of the remedy has to be followed by a cathartic, to produce increased peristalsis.

FILIX-MAS (male fern)—The official oleoresin is a dark, thick liquid of a bitter, nauseous, slightly acrid taste. It is used to expel tape worms and is usually not dangerous, though in some instances it has caused excessive vomiting, purging, cramps, convulsions, stupor, coma and collapse. It has to be used with caution. Pumpkin seed, also employed in the treatment of tape worm, is harmless.

CUSO is derived from the flowers of a native tree of Abyssinia, and is another remedy against this parasite. The bark of the stem and root of the pomegranate is also an efficient remedy for tape worm. It is the remedy for treating round worms and thread worms. Large doses cause disturbances of vision ("yellow vision"), occasionally followed by blindness, lasting a few weeks, drop of temperature, stupor, tremors, convulsions and respiratory paralysis. The urine is of a green yellowish color and turns red on addition of sodium hydroxide.

SANTONIN, a glutosoid, from the German wormwood, *artemisias martima*. Soluble in water. Slightly soluble in the stomach; acts mainly in the intestines. It is the best remedy to destroy roundworms and is solely used for that purpose. Intestines should be emptied before giving the drug and the laxative repeated a few hours after its administration.

FOODS—the natural and artificial foods—Proteids, carbohydrates, fats, water and salts and their actions have been discussed in former chapters.

The mineral constituents of the body have to be administered in medicinal doses when they have not been present in sufficient quantities in the daily diet, and occasionally, in conditions when the assimilating power of the organism is below par for one or the other of these substances. Their administration in larger doses in such conditions gives sometimes good results, probably by their action as specific stimulants for assimilation, when given in such doses.

CHEMOTHERAPY IN SPECIAL DISEASES

THE INFECTIOUS DISEASES.

Prophylaxis, isolation and disinfections are paramount indications in the treatment of these diseases, to prevent the bacteria that cause them from entering the organism to neutralize their toxins, to prevent their growth and to destroy them after they have entered. The acute infectious diseases are all characterized by prodromes during the time of incubation, by a more or less sudden onset, with chills, fever, pains and a very marked disturbed circulation. It is the time when the organism is flooded with bacterial toxins and succumbs. Though this condition is rapidly improved with the employment of physiologic means, drugs are necessary in all, such as an antiseptic mouth wash, a saline enema to clean the lower bowels, a purgative in most cases, and bowel antiseptics to stop and to prevent excessive fermentation; Antipyretics to treat hyperpyrexia, the active principles to stimulate or to depress organic functions, and antiseptics and disinfectants to neutralize toxins and to destroy germs. All are necessary to free the blood from impurities and to bring it where needed.

THE EXANTHEMATOUS FEVERS. In measles the treatment has to be symptomatic. These patients are usually sensitive to light and subject to colds. Mouth hygiene and attention to thorough bowel evacuations with laxatives or enema are necessary in every case. Occasionally minute doses of codeine may be given to lessen irritation. As antipyretics, quinine or antipyrine act well in cases of hyperpyrexia and the sulphocarbolates or bismuth when bowel antiseptics are indicated. Lungs, heart and kidneys have to be closely watched.

CHICKEN POX. This disease has to be treated on the same plan. Itching of the skin is lessened by alkaline washes, the application of a menthol or thymol ointment or dusting powder, when the skin is moist.

SCARLET FEVER. The severity of a single case depends upon the character of the epidemic. In all cases, the greatest care is necessary as slight infection may be followed by grave symptoms. Mouth hygiene has to be strict. Alkaline washes should be used. Antipyretics are usually contraindicated; they are badly borne in this disease by children and adults; they may be cautiously administered in small doses when necessary. Inflamed glands of the neck are best treated with iodine ointment. Heart and kidneys have to be watched in this and all other infectious diseases. A large amount of liquid in form of milk, butter-milk, lemonades, or pure water, is indicated to protect the kidneys, which have to be watched for a long time after the disease has run its course—free evacuation of the bowels in any case.

ERYSIPELAS—Any of the antipyretics may be given for excessively high temperature, though this is rarely necessary, as the fever shows deep remissions. Waugh advises pilocarpine in small and repeated doses (gr. 1-12 to 1-6) in thenic cases; full doses of the tincture of iron in athenic cases to cut the attack short. Heart weakness has to be treated with stimulants, camphor, caffeine, etc. The local treatment consists in the application of a 50% ichthyol ointment or moist application with boric acid or leadwater.

SMALLPOX has to be treated as are other diseases for hyperpyrexia and with regard for mouth hygiene, bowel antiseptics and for fetid stools. Ice-cold, later cool applications to relieve tension of the skin and heat, hyoscyamine for delirium, the prolonged lukewarm bath to relieve itching, and red light to prevent pitting.

DIPHTHERIA. The treatment with antitoxin makes almost any other treatment superfluous. Camphor, caffeine and adrenaline for heart weakness and milk diet to prevent kidney disease. Intubation and tracheotomy for severe cases.

PERTUSSIS—Quinine in a teaspoon of Yerba Santa syrup or in chocolate tablets, or equinine instead, may be given. Atropine as antispasmodic in small and repeated doses, codein or morphine in small doses only, when constant supervision is possible.

Chloralhydrate, antipyrène, sodium bromide and bromoform are frequently used. The doses have to be carefully suited to the age of the child, and the strong narcotics only given in the severe cases. Local treatment of nose and throat may be employed with advantage.

PAROTITIS (MUMPS)—The general rules have to be observed. Calcium sulphide given internally, and an ointment applied to the swollen gland.

CHOLERA, ASIATIC AND COLERA MORBUS—The intestines have to be thoroughly evacuated with castor oil or calomel, and bowel antiseptics must be used, until the stools are odorless. Opium and atropine for pain and colics and enteroclysis to replace lost liquids. Tannin preparations may be given by injections or by clyisma, and subcutaneous and intravenous injections of normal salt solutions or Ringers solution may become necessary. Heart weakness and collapse symptoms have to be treated as usual with camphor, caffeine, atropine, strychnine and digitalis preparations.

DYSENTERY—As in the treatment of Cholera, the intestines have to be evacuated with castor oil and calomel and magnesium sulphate, or sodium sulphate in the beginning 10-20 grs.—later in larger doses at intervals. This often cures. Ipecac is an old remedy and gives good results. One drachm of the fluid extract or powder with just enough water to swallow it. If the dose is vomited, it has to be repeated. Various forms of administration, especially of ipecac, the alkaloid emetin, have been given by various observers. All act with good results. Colics and pain have to be treated with the narcotics, not enough to lock up the bowels. Hemorrhages, with atropine, calciumchloride, gelatin and adrenalin. Tannin solution 0.5% by clyisma has given excellent results in amebic dysentery. It kills the parasites in two minutes and frees the intestines from the ameba mechanically by washing them away.

TYPHOID FEVER—An initial large dose of calomel is indicated and intestinal antiseptics have to be used freely to prevent excessive fermentation. The sulfocarbolates do not irritate the stomach and are efficient. Bismuth may have to be added and atropin, codein and morphine, if diarrhoea is excessive accompanied by pain and colic. The bowels must be kept open. Turpentine stupes and turpentine by mouth in milk to relieve meteorism.

Hemorrhages have to be treated with atropine. Opium and gelatine subcutaneously injected, or adrenaline, ten drops of a solution of 1:1000, stypticin, etc. Ice water enemas are highly recommended. Thorough mouth hygiene will usually prevent pneumonia. Kidneys, heart and lungs have to be closely watched, as in other infectious diseases.

INFLUENZA is marked by general malaise, pains in joints and muscles and an inflammation of the mucous membranes of the respiratory and digestive tract, sometime affecting the one or the other more severely, it has to be treated on the plan outlined for the other infectious diseases. Locally, keep the nose and mouth in good condition, use antiseptics for fetid stools and excessive fermentation, for pain and hyperpyrexia aconite in small and repeated doses with the salicilates and antipyretics; treating cough with inhalations and narcotics. Heart, lungs and kidneys have to be carefully watched. Cold applications are poorly borne by these patients, instead heat and sweating processes are agreeable to most. Bronchitis, croupous and capillary pneumonia that may accompany or follow the disease will be discussed later. Convalescence has to be carefully conducted as heart weakness, relapse and tuberculosis may follow.

SEPTICEMIA—Colloidal silver preparations may be called specific, though their employment gives good results only in a certain number of cases, and usually fails in severe general sepsis. An intravenous injection is followed by a light chill or chilliness, diminution of leucocytes followed by pronounced leucocytosis—10-20 C. C. M. of a 2% solution are injected into the vein. Subcutaneous injections are painful and may cause abscess formation. Inunctions with Credes ointment, or enemas of 100g of a 1% solution, once a day, after the lower bowels have been washed may be given instead. All organs have to be looked after, and heart and circulation, as in other diseases, especially cared for.

MALARIA—Quinine acts as a specific. It kills the plasmodia and various methods to give it are in use. The blood must be saturated with quinine between the chills and either one large dose may be given for this purpose—fifteen grs., and more, or three or four ten grs. doses during the day. This treatment has to be continued for three or four days. Quinine will be better absorbed and act better when given between the chills, when the internal congestion is relieved and the equilibrium of the circulation re-established. A treatment with similar large doses every

seventh day for several weeks will prevent the development of new crops of parasites. To prevent the disagreeable and often dangerous cynchonism, hydrobromate of quinine is preferable—each dose followed with ten to fifteen grs. of sodium bromide and ten grs. of the diluted hydrobromic acid in solution. When given in this way, the patient will often not know that he has taken quinine.

Others prefer to give a large number of smaller doses during the day until at least fifteen to thirty grs. per diem are reached. If the patients are comatose, hypodermic injections have to be used instead. Use methylanoblue in cases that cannot bear quinine and Warburg's tincture in chronic and malignant cases.

The anemia following the chronic forms of malaria is best treated with arsenic, which also acts as a specific against the more durable forms of the parasite. Cacodylate of soda by hypodermic injections, Salvarsan, Fowler's solution, arsenous acid and other arsenic preparations.

DISEASES OF THE LUNGS.

BRONCHITIS—The physiologic methods, rest in bed the sweat bath, the hot foot bath, hot drinks, inhalation, etc., with attention to diet and bowel evacuations are usually sufficient to cure, though stimulating expectorants, the chloride and carbonate of ammonium may have to be given to liquify mucous and as stimulant to the feeble. Treatment of nose and throat are necessary. Severe convulsive dry coughs are relieved by apomorphine, emetine, codein and by diluted hydrocyanic acid.

CHRONIC BRONCHITIS—The same measures have to be used for the chronic forms of bronchitis, and drugs employed to liquify the excretion, to lessen their amount and to stop constant irritation, that is—to lessen cough. The hot mineral waters, iodine preparations, ammonium muriate, apomorphine and inhalations for the former purpose. The balsams, terpin, or turpentine, a few drops in milk, and atropin to lessen secretions, warm inhalations, and in severe cases, narcotics, codein, dionin, morphine and scapolamine, etc., to lessen cough.

CAPILLARY BRONCHITIS—Bath and inhalations are the most important therapeutic measures in the treatment of this disease. Mustard is usually added to the water. It produces an intense hyperemia of the skin. Instead, the mustard pack may be used. Hot inhalations, warm drinks, ammonium carbonate,

senega and squills are sometimes useful. The heart has to be closely watched and digitalis, camphor and caffeine given when weakness is manifest.

BRONCHIAL ASTHMA—A special irritant, a very sensitive or diseased mucous membrane of nose, throat and bronchi, and great lability of the nervous system, "the predisposition", are necessary to produce the disease. Hysteria, neurasthenia, the visceral neuroses, hayfever and asthma are associated with enteroptosis, a condition that causes serious circulatory disturbances and irritation of nerve centers. The treatment aims to relieve the spasms, which may be accomplished with belladonna, atropine, hyoscyamine, inhalation of amylnitrate or nitre fumes, the smoking of the asthma cigarettes etc. by influencing the sticky bronchial secretions, potassium iodide gives usually the best results, and by changing the climate, that is, by removing the patient from the source of trouble. This is usually difficult. Some will do well in a mountainous region, and others on the seashore: the suitable climate has to be found by experience. Of greatest importance is the treatment between the attacks, to relieve the general condition, the enteroptosis, the administration of pituitary extract in large doses continued for months and cacodylate of soda given subcutaneously by hypodermic injection, combined with the physiologic methods of treatment have given excellent results. Nose (asthma nasale), uterus (uterine asthma) and stomach (stomach asthma) have to be carefully examined and treated as indicated.

EMPHYSEMA—Chronic bronchitis is usually associated with this disease. It has to be treated according to its condition and cause. Heart weakness and heart disease, often a companion of this trouble, has to be considered. Narcotics have to be used in severe cases to produce sleep. General improvement follows the improvement of the bronchitis. The treatment with physiological methods is in this, as in all other diseases, of importance. The dyspnoea is due to the condition of the lungs, of the heart, or of both.

LOBAR PNEUMONIA is characterized by an intense disturbance of the circulation, marked by chill and cyanosis and is best relieved by absolute rest in bed, a large warm enema, followed by a calomel purge, hot foot-bath with ice pack to the head and counter irritation with antiphlogistin or mustard poultice over the seat of trouble. Mouth hygiene is of great importance as the mouth cavity is an incubator for the pneumococci. Aconite,

administered best as aconitine in repeated doses to effect, to keep up the equilibrium of the circulation. The heart has to be fortified with caffein, strychnine, and digitalis, if needed. Collapse has to be treated as usual, with camphor, caffeine, atropine, etc. In some cases venesection may become necessary to relieve the right heart. Drinkers have to be given alcohol in sufficient doses. For delirium, hydrotherapeutic measures, potassium bromide, veronal and if there is no contra-indication, (difficult expectoration), hyoscyamine or morphine in small doses to quiet and to procure sleep; in most cases luminal sodium is a good quiescent. Oxygen inhalation to relieve dyspnea. Abscess, pericarditis, endocarditis, nephritis, diarrhoea and other complications that may arise in the course of the disease have to be treated as usual. Internal antiseptics have not given satisfactory results, though a number of them have been tried and advocated by some observers, especially the salicylates.

LOBULAR PNEUMONIA has to be treated like capillary bronchitis. Warm, moist inhalations and stimulation to the respiration, mustard bath and pack, warm bath with cold ablutions, hot bath of short duration, etc. Methodical deep inspirations practiced daily after severe infectious diseases that are often followed by capillary bronchitis and lobular pneumonia frequently prevent the attack.

CHRONIC PNEUMONIA—The treatment is the same as that of emphysema and tuberculosis.

TUBERCULOSIS—The treatment with the physiologic method is by far the most important in this disease. Creosote and guagacol have acquired a reputation. It is now generally admitted, that they do not act as specific, but increase appetite and cause general improvement. They have to be discontinued if they disturb appetite and digestion. Iodoform, which gives good results in local affections has also been used internally, and I have given it to a very large number of patients, and always have been under the impression that the patients derive benefit from its administration. Arsenic by subcutaneous injection or by mouth, cacodylate of soda is a valuable adjuvant in the treatment of this, as in all chronic diseases. Heart weakness, excessive night sweats, cough and high fever, and other symptoms have to be treated as usual, though with care and caution. Light hemorrhages are treated with absolute rest, application of

ice, and an injection of atropine and morphine. Injections of gelatine and ergotine, adrenaline, stypticine or gelatine internally may be tried with calciumchloride to increase the coagulability of the blood. Pituitary extract has given excellent results in the treatment of tuberculosis.

PLEURITIS—Dry pleurisy heals usually by simple rest in bed. Hot teas and hot foot bath are added to produce diaphoresis. Counter-irritants, antiphlogistin or the mustard poultice and the salicilates to stop pain are valuable adjuvants. Syphilis and tuberculosis have to be **thought of**.

PLEURITIS WITH EXUDATION—The salicilates, if of rheumatic origin, are of benefit. Dry, in weak individuals, or wet cupping in robust individuals. Diaphoresis, the administration of diuretics and of purgatives to increase elimination and attention to the circulation to restore a disturbed equilibrium and to cause absorption of the liquid, all of which the patient needs. A thickened pleura following an exudative pleurisy is to be treated with the physiologic methods and injections of Thiostrinamin (antifebrilosin).

SYPHILIS—Mercury is an old tried remedy with which to treat this disease. It is given by inunction, bichloride bath, by intramuscular and intravenous injections, as colloidal mercury, by inhalation and by mouth. The inunction treatment is the best to some extent an inhalation treatment. Mercury evaporate readily at room temperature. The bath method is of especial advantage when large skin affections are present. When intramuscular injections are used, special care has to be taken to avoid blood vessels. After the needle has been injected, the piston has to be slightly drawn up; and a new injection made, if blood flows into the syringe. Soluble or insoluble preparations may be used according to indications. A 1½% solution has to be injected daily or every other day, until thirty or forty injections are made, if the former are used, whereas, if emulsions made of insoluble salts are employed, fifteen to twenty injections are given, one every fifth or sixth day, which is usually sufficient to complete one course of treatment. If this latter method is used, the first injections should consist of not more than from 2.5 Cc of a 10% emulsion and full doses should not be given till the tolerance of the patient has been ascertained. Of the soluble compounds, sublimate dissolved in sodium chloride and water, sokoiodol-mercury dissolved in potassium iodide and water, and enesol a compound con-

sisting of salicilarsonic acid, mercury and free arsenic and, the colloidal mercury are most frequently used. Of the insoluble salts, the salicilate of mercury suspended in olive oil or liquid paraffine is most widely employed. Calomel acts more energetically, but is of greater toxicity and has to be used with great caution.

Mercury preparations should only be given internally to patients with a perfectly healthy gastro-intestinal tract, and never in the beginning of treatment—they are far less efficient than when given by inunction or injection. They can only be administered in very small doses, and of these only a small part is absorbed. Mercury preparations should never be given on an empty stomach. The bichloride of mercury, calomel, the iodides of mercury and many other preparations are used for internal administration. A strict mouth hygiene is necessary in every case of mercurial treatment to prevent stomatitis. Chlorate of potash in 10% solution makes an excellent mouth wash for this purpose, and should be used four times daily. The treatment has to be discontinued as soon as inflammatory changes are observed in the mouth and smoking must be interdicted during the treatment.

It is well to follow mercurial and arsenic treatments with iodine, not alone on account of the specific action it has, but also on account of its effect upon metabolism and its power to increase mercury elimination.

Potassium and sodium iodide are best given in milk or buttermilk, in gradually increasing doses. A number of preparations have been introduced, which are supposed not to cause iodism. Of these sajodin, iodipin and iodalbumin may be mentioned. Iodipin can be given by intramuscular injection. Besides this a number of vegetable compounds have been used as adjuvants in the treatment of syphilis, of which Zittman's decoction and the *succus alterans* are the best known.

Tertiary syphilis is best treated in conjunction with iodine, gumma and gummatous processes are rapidly cured by it and it benefits all later syphilitic affections with such certainty that in many instances this may serve to make the diagnosis.

Atoxyl was used in the treatment of syphilis by Uhlenhuth, but it was abandoned on account of its great toxic effect upon the nervous system—atrophy of the optic nerve was not rarely observed.

Ehrlich, as mentioned before, took this preparation as a basis for his investigations and testing each new derivative therapeutic-

ally on animals could bring forward, first arsacetin which is far less toxic than atoxyl and finally salvarsan. The object of this research was to find a preparation which with one blow would sterilize the body, relieve symptoms and cure. "Therapia magna sterilisans."

After a vast number of experiments, Ehrlich was under the impression that he had found this in his 606 preparation "Dioxydiamido arsenobenzol" (Salvarsan). The observations made up to the present have shown beyond a doubt that it has a specific action upon the spirochaetae, that its toxicity is comparatively slight, and that it is, therefore, a valuable remedy in the treatment of syphilis, but that on the other hand one injection will not cure, except in a few cases of fresh infection. Too many of the micro-organisms grow in places where the blood supply is not sufficient to bring the remedy in quantity to kill them all with one injection, and mercury is still considered superior, as a specific. Salvarsan is invaluable in cases of malignant syphilis where mercury fails and in cases in which the spirochaetae have become immune against mercury. It seems best to use it in all cases of syphilis or in most; intermittently with mercury treatment. It is best given intravenously, though Neo-Salvarsan may be used by intramuscular injections without causing the large infiltrations that made this method impossible with salvarsan.

The plan adopted by many clinicians is to commence with an intravenous injection of salvarsan, follow with mercury by inunction or injection, and again use salvarsan, etc.

Instead, Enesol or Cacodylate of Soda injections may be used. Of the latter twenty to thirty injections may be made, using the contents of one or two of the original bulbs of the cacodylate, twenty intramuscular injections of three to seven decigrams and more into the gluteals. Either method gives good results. The injection is not painful and of little toxicity.

ACUTE ARTICULAR RHEUMATISM—A thorough mouth hygiene is necessary in the treatment of this disease, which is frequently preceded by tonsillitis. Chemotherapy is indicated in all cases. It seems we possess means that act specifically, though the micro-organism causing the disease has not been isolated.

Pure Salicylic acid is rarely used, as it has to be given in hourly doses to produce results. Sodium salicylate is largely employed, three to four doses of about ten grs. each, during the day, are sufficient to bring the patient under the influence of the

drug. It may be given by rectal injections after the colon has been washed.

Aspirin, Diplosal and Sodium Salicylate are the best of a large number of salicylic preparations. Roaring in the ears, nausea, disturbances of the digestion, delirium, dyspnoea, skin eruptions and albuminuria, following the administration of the salicylates, occasionally force a discontinuation of the remedy.

Antipyrine and phenacetin, like the salicylates, act specifically in articular rheumatism, and may be used when the former are not well borne, or when for other reasons a substitute is needed.

Heart complications have to be treated as usual. The salicylates exert very little influence upon their course. The salicylates do not act in joint inflammations accompanying or following other infectious diseases—scarlatina, septicaemia, gonorrhoea and so on.

CHRONIC RHEUMATISM AND ARTHRITIS DEFORMANS—These two diseases are clinically difficult to differentiate. The acute form may become chronic and pass into arthritis deformans. Chronic rheumatism is characterized by an inflammation of the synovial membranes, causing fibrous degeneration, osseous growth and ankylosis of the joints. Whereas, arthritis deformans is diagnosed by cartilaginous and osseous proliferation and atrophy without obliteration of the joints.

Local treatment of the affected joints with the physiological methods and with various ointments, especially veratrine and mercurial ointments, is useful.

Internally the salicylates act best when the attacks come periodically. The iodides, bryonine, colchicine, aconitine and arsenic all act beneficially in some cases. Massage, hydrotherapy and climatotherapy should be employed in all cases. Arsenic has given in this disease, as in many chronic diseases, good results.

RACHITIS is a disease of childhood and of unhygienic conditions. Its main symptoms are soft and large bones, due to an insufficient quantity of lime. The physiologic methods of treatment are of the greatest importance. The question has to be considered, whether the disease is due to an insufficient assimilation of lime salts, to their increased elimination or whether due to a diet poor in lime salts. Fats are needed in every case and codliver oil enjoys a great reputation. To this phosphor should be added, as it, according to some investigators, increases the assimilation of minerals. General improvement is observed in all cases during

its administration. The treatment has to be continued for a long time. Lecithin, nuclein and other phosphor preparations have been more recently introduced.

DISEASES OF METABOLISM

GOUT—The acute attack. The pain in the affected joints may be treated with a "Priesnitz bandage" with an icebag, a cold application of a solution of aluminum acetate, or with hot applications and antiphlogistine, or the official caoline paste; whatever gives greatest relief should be used.

Colchicum and its various preparations act almost specifically and it is best given in the form of Colchicine, in frequently repeated minute doses to effect, or till toxic symptoms appear. Some prefer the wine or tincture of colchicum with the idea that active substances besides the alkaloid are active in these preparations. A number of proprietary and patent remedies are on the market, all of which contain colchicum in some form. Liqueur de Lavalle gives good results. Next to the colchicum, the salicylates act best to influence the attack. In many cases dionine or morphine are necessary to stop the excruciating pain. The iodides are valuable adjuvants in the treatment and may be combined with colchicum and the salicylates.

CHRONIC GOUT—The alkalies and the alkaline mineral waters have been used since time immemorial and are used today in this disease, though no scientific proof of their efficiency can be brought. Probably the diet free of purines and other physiologic methods used at the watering places, may explain their effects. Organic bases like piperazin and others once so largely prescribed have been abandoned. The treatment with lemon, orange and the gr pe are still popular. Urotropin, citarine and similar preparations are occasionally useful.

DIABETES MELLITUS—The treatment with the physiologic methods, especially starvation and diet, are the most important. A large number of remedies have been recommended as adjuvants. Arsenic, quinine, the salicylates, iodoform emetin and many more. One or several of these may be indicated in various cases. Arsenic gives good result, probably by stimulating the blood making organs. Opium diminishes the glysuria. It acts well, especially in cases where nervous excitation is a prominent factor. However, a continued treatment with opium is dangerous, and should not be given. Pancreas preparations, in cases of pancreas

diabetes, are useful. Acidosis is to be treated with alkalies or the alkaline mineral waters. Gangrene has to be treated very strictly according to the general rules, and atropine in small and repeated doses should be tried in every case.

DIABETES INSIPIDUS is an anomaly of secretion of the kidneys, the polydipsia is secondary. The kidneys are unable to excrete normal urine and consequently need large quantities of water especially for the elimination of sodium chloride and urea. A diet poor in table salt and substances that produce urea is, therefore, of importance. A vegetable diet should be prescribed with the main meal in the middle of the day and water should not be taken before bedtime to avoid frequent urination at night and the disturbance of sleep caused by it. A number of remedies have been recommended of which atropine is by far the best to use as an adjuvant, except when syphilis is the cause of the trouble.

DISEASES OF THE GASTRO INTESTINAL TRACT AND OF THE OESOPHAGUS.

CARCINOMA OF THE OESOPHAGUS—Constant difficulty of deglutition, loss of appetite and vomiting immediately after swallowing by patients over forty years of age, with exclusion of lues and stricture of the oesophagus due to ingestion of caustics are the cardinal points of diagnosis. If the seat of the tumor is high up and the diagnosis made early, a radical operation is indicated. If near the cardia, an enterostomy may become necessary. The Wasserman's reaction should be made and the iodides should be given to exclude the possibility of syphilis. Atropine, belladonna, eucaine and cocaine are useful to relax the stricture and to produce a local anesthesia. The latter preparations are best injected through a Nelaton catheter. Stagnating food remnants are then siphoned off, followed by careful washing with luke warm water and an injection of pure olive oil. An hour later, the patient is permitted to eat. Dilatation of the stricture by introducing bougies is rarely used, because it irritates.

General treatment with the physiologic methods, especially a carefully selected diet, has to be employed in conjunction with this treatment.

ULCERS of the oesophagus may be catarrhal in character, or they may be due to syphilis, tuberculosis malignancy, or the ingestion of caustics. All cause a severe burning sensation and pain behind the sternum. Aside from the treatment of a specific infec-

tion, it has to be symptomatic; atropine, belladonna and cocaine, as before, to stop pain and relax the stricture. Nitrate of silver in tablespoon doses three times daily of a solution of 0.5:200 of water, as astringent and caustic, and sweet almond oil or olive oil before eating to protect the wound. Diet as in carcinoma.

Benign esophageal strictures following ulcerations should be treated with bougies and hypodermic or intramuscular injections of thioscynamine; spastic strictures are best relieved by treating Hysteria—their cause. Dilatations are to be treated similarly, like strictures, medicinally and mechanically. If foreign substances have been swallowed and are held in the oesophagus, they have to be removed mechanically with the oesophagoscope, and if that is not possible, an injection of morphine and atropine has to be made to release the substance and allow it to pass into the stomach. A diet of mashed potatoes prepared with a great amount of butter and cream has to be prescribed for several days to envelope the foreign body and pass it through the intestines.

The swallowing of air, followed by loud explosive eructations and hyper-esthesia of the oesophagus, both due to hysteria and neurasthenia, have to be treated in the same manner as these affections, with physiologic methods and with nervines.

DISEASES OF THE STOMACH

The stomach is affected by almost every disease. Indigestion, fullness, pressure and pain in the epigastrium are often early symptoms of serious and various organic diseases. The acute and chronic infectious diseases, the diseases of metabolism, of the heart, liver, kidneys, pancreas, bladder and of the intestines all are accompanied by affections of the stomach and of the functional neuroses, as constant symptoms. Severe, boring, cutting pain, radiating towards the back and sides, in every direction, is always a symptom of an organic disease of the stomach itself, or of its neighboring organs, heart, liver, pancreas, etc., whereas, fullness after eating, uneasiness and oppression are frequently symptoms of a neurosis.

ACUTE GASTRITIS usually following the ingestion of indigestible food is characterized by pain in the epigastrium, increased on pressure, by swelling of liver and spleen, and often by jaundice. The stomach has to be emptied by lavage or an emetic and purgative like castor oil, or calomel administered, if

the ingesta have passed into the intestines. Atropine should be given to relieve pain and hydrochloric acid to stimulate secretion. Diet and rest until patient is restored.

CHRONIC GASTRITIS—Faulty diet, insufficient chewing, abuse of alcohol, laxatives, etc., are the cause of the primary affection and carcinoma of the stomach, heart, liver and kidney diseases may cause an inflammation of the stomach secondarily. Pressure, pain and fullness after ingestion of hard food is the most important symptom. The remote cause has to be treated and a suitable *bland* and *soft* diet prescribed.

If the gastritis is acid, use atropine and belladonna to diminish secretions, bitters to increase appetite and the anacida two hours after eating to neutralize the excess of acid. Atropine and belladonna combined with magnesia, bismuth and bicarbonate of soda, is indicated if the pain is severe. In anacid gastritis, the bitters one hour before eating and hydrochloric acid after eating act well. Pepsin, papajotin, pancreatin, and similar preparations may be given in addition.

The alkaline mineral waters, Karlsbad, Vichy, etc., are valuable. One glassful, warm, one hour before eating, in acid gastritis, and, in anacid gastritis, those that contain sodium chloride, Kissingen, Homburg, etc., continued for weeks after acute symptoms have passed.

GASTRIC ULCER—Tuberculosis and syphilis are not rarely the basis of the trouble. It is most frequently found in Chlorotics, and in women at the time of the meno-pause, in men, excessive drinking and smoking is usually the cause. The cardinal diagnostic points in typical cases are severe pain from one to four hours after eating, in the epigastrium, hemorrhage in some cases, and hyperchloridia.

The physiologic methods of treatment are of greatest importance. Internally, nitrate of silver, 0.5:200, a tablespoonful three times daily or bismuth, a teaspoonful in a glass of warm water early in the morning; atropine and belladonna combined with calcined magnesia and bismuth two hours after eating, if the former medication does not stop the pain. If this fails, one-half to one wineglass of warm olive oil, morning and evening and from one to two tablespoonsful before meals, will often effect a cure.

Employ surgical treatment in cases of perforation, chronic hemorrhages and sequels like scars, hourglass contractions, etc.

Rest and a treatment with mineral waters in every case after the ulcers have healed. Diagnosis and treatment of duodenal ulcers are practically those of ulcer of the stomach. They are often difficult to differentiate.

CARCINOMA OF THE STOMACH—Loss of appetite, aversion against meat, general malaise and finally cachexia; pressure after eating hard food, severe colicky pains in the epigastrium and vomiting of coffeegrounds appearance, absence of hydrochloric acid, or pepsin and labferment, presence of lactic acid in pyloric carcinoma, constipation and hard tumor, are symptoms of typical cases.

Lavage of the stomach to remove stagnating and fermenting ingesta is followed with an injection of olive oil in pylorus carcinoma.

Internally, fluid extract of condurango, before eating. Hydrochloric acid after eating and atropine and belladonna for pain. Morphine is necessary in the later state of the disease. Radical operation is indicated in all cases in which a stenosis of the pylorus has been diagnosed, if the tumor is not too far advanced. Paliative measures may become necessary in the later stage of such cases.

If the seat of the growth is the wall or the cardia, it is useless to advise a radical operation.

DILATATION of the stomach, copious periodical vomiting of food taken several days before, colicky pains in the epigastrium, decrease of the daily quantity of urine, lower curvature of stomach below the navel and splashing, are the symptoms. In benign strictures of the pylorus due to spasms, erosions and ulcer, hydrochloric acid, sarcinae and yeast cells are present in the stomach contents, and absent when the dilation is caused by carcinoma. In that case, Boas bacilli and lactic acid are found and hydrochloric acid is absent. The treatment is mechanical and internal, as before, and if this fails, surgery must be resorted to.

THE NEUROSES of the stomach are characterized by fullness after eating, sour stomach, and oppression. They are always associated with hysteria and neurasthenia, the basis of which is enteroptosis.

Treatment:—Aside from the symptomatic treatment, hydrochloric acid, after eating, when acid secretion is deficient, the anacida should be used when there is excessive secretion, and the bitters should be employed to increase appetite and atropine or

belladonna to lessen peristalsis and secretion. This is the usual treatment in this affection. Enteroptosis is also a predisposing cause for tuberculosis. Insufficient blood supply to the chest organs, small heart and undeveloped lungs are the consequence. The symptoms of dyspepsia found as an early symptom of phthisis are due to congestion of the abdominal organs. The treatment is that of tuberculosis and of the neuroses.

THE DISEASES OF THE INTESTINES

It is of importance to differentiate and find the cause of what may be an acute or chronic disease of the stomach, of the peritoneum, heart, liver, kidneys, or spleen. The disease may be due to the infectious diseases, or to intoxication, with lead, arsenic, ptomaines, etc., or a nervous disease, organic or functional may be the cause. Fullness, distention, flatuency, nausea, vomiting, severe pain radiating from the navel in every direction, cramps and colics, girdle sensation, diarrhoea and constipation are the subjective symptoms. Rise of temperature, mucus, blood, pus, ova and parasites, calculi, undigested food in the dejections, etc., are the objective symptoms of intestinal disease.

An acute intestinal catarrh usually follows an acute inflammation of the stomach, though it may be found independent. Swallowing of indigestible food, intoxications, infections, colds and chilling, are frequently the cause, and severe colicky pains, diarrhoea and rise of temperature, the main symptoms.

The treatment is evacuation of stomach and intestines, rest in bed, hot applications, warm drinks and no solid food, until the temperature has become normal and pain has ceased. Atropine and belladonna to lessen peristalsis and to stop pain. Tannin preparations and the sulfocarbolates to act astringently and antiseptically.

Laxatives if pain and fever do not cease under this treatment within a few days.

CHRONIC INTESTINAL CATARRH—If the disease is due to affections of the heart, liver, kidneys, etc., therapeutic measures have to be directed to the cause. The catarrh has to be treated with warm dressing, to prevent chilling, with suitable diet, warm or hot enemas medicated with tannin preparations or Karlsbad salt in severer cases, and hot mineral waters internally, selected according to the acidity or anacidity of the stomach. **Pain** has to be stopped and the bowels have to be regulated. **Atropine** and belladonna, bismuth, tannin preparations, the lime salts, the sulfocarbolates, and coppersalts in minute quantity, may be used.

Mucous Colic, usually found associated with chronic constipation, in hysteric and neurasthenic individuals, is due to a catarrh of the colon. The treatment of the constipation and general condition of the patient will cure the disease. Warm olive oil enemas act well.

FLATULENCY AND METEORISM—Flatulency is marked by the expelling of gas and meteorism by the distention of the abdomen, symptoms of an intestinal catarrh, due to excessive fermentation of abnormal contents, mucus is mixed with them. Meteorism found in hysteric and neurasthenic patients, is usually caused by colonic spasms that do not allow the gas to pass. The treatment is that of the catarrh. The mineral waters, warm when constipation is a symptom and hot when diarrhoea accompanies the catarrh. They should be given one hour before meals. In light cases valerian, peppermint and other carminatives in form of teas and, in severer cases, atropine and belladonna, to relieve the spasms.

STERCORAL TYPHLITIS AND CATARRHAL PURULENT AND GANGRENOUS APPENDICITIS—The symptoms are pain, fever, tumor, constipation, rigidity of the right rectus, leucocytosis, rapid pulse,—important to differentiate from colics, etc. The most frequent cause is an acute catarrh of the bowels that forces abnormal intestinal contents into the appendix.

A stercoracious typhlitis is difficult to differentiate from appendicitis and sometimes impossible.

In the acute form, dull pain sausage like tumor, rarely, constipation and fever—it corresponds to the intestinal catarrh, if present. In the chronic form, pain and tumor, gurgling when diarrhoea is present, no fever. Evacuation of the bowels and hot applications relieve.

Acute catarrhal appendicitis is marked by intense cutting pains in McBurney's point, radiating in every direction, rapidly growing tumor, high fever and chills, rapid pulse and constipation. Hot applications increase pain, ice is grateful. If purulent, leucocytosis is present. Diarrhoea speaks usually in favor of stercoracious typhlitis and so does constipation without fever. Immediate operation is necessary in cases of purulent and gangrenous appendicitis (perforation) especially in young individuals. No adhesions are formed in these cases to protect. Chronic appendicitis requires surgical intervention, when pus is

present and medical treatment has failed. Rest in bed, hot applications in typhlitis and chronic appendicitis, ice in acute appendicitis, opium, morphine, atropine and belladonna, to stop pain and quiet the intestines, warm olive oil enemas cautiously given to produce evacuations and the antiseptics to control excessive fermentation. In all cases, as well as in the doubtful, starvation during the first few days is absolutely necessary, even withdrawing all water by mouth, if the onset is severe.

The treatment of tumors of the intestines is surgical. A displacement of the intestines frequently found with enteroptosis and leading frequently to disturbances and catarrh with constipation and diarrhoea, have to be treated in the same manner as this disease.

Strictures, characterized by the peculiar shape of the dijections, pencil like, pressed to ribbon form, visible peristalsis, etc., have to be treated surgically when due to neoplasms or scars, though intramuscular injections with thioscincamsine (antifebrilisine) may be tried. Spastic strictures in enteroptotics have to be treated according to the general rules discussed.

The same causes that produce strictures may cause a complete obstruction (ileus), external and internal hernias, malignant and benign growth, invagination, strangulation, paralysis and spasms, compressions by neighboring organs, especially of the gravid uterus, etc. Retention of gas and stool, meteorism, nausea, vomiting of intestinal contents, eructations, singultus, colics, collapse, peritonitis and high fever, are the symptoms.

A laxative, castor oil and high warm enemas of from two to three quarts of warm water, are indicated in the absence of fever and colics, as the stenosis in these cases is probably due to accumulation of fecal matter. Atropine and belladonna, if pain is present, and olive oil injections, if the water does not produce evacuations. If fever is present, ice, atropine and opium at once. These therapeutic measures may be continued for several days if they give relief, and if no collapse symptoms, thready pulse, singultus, stercoraceous vomiting, etc., appear. A consulting surgeon should be called in every case of obstruction and an operation advised if the patient does not improve under the treatment and the above symptoms appear, unless an inoperable malignant growth is the cause, when palliative treatment, rest, diet and narcotics have to be used.

PERITONITIS, ACUTE AND CHRONIC, is occasionally a complication of the diseases of the stomach and intestines. It may be dry, serous or purulent, circumscribed or diffuse. The acute forms are due to perforation. The symptoms are severe cutting pains, increased on pressure, when diffuse, on touch, fever, tumor, nausea, vomiting, frequent desire to urinate and singultus. The pain is most severe at the place of perforation. Operation may save life.

Chronic diffuse peritonitis is mostly due to tuberculosis and malignant growth. The treatment of the circumscribed adhesive form requires rest in bed, hot compresses, atropine and belladonna, suppositories, if the location is low in the abdomen. Later, a bandage, and caution not to tax the abdominal muscles. Lift-
of weights must be strictly forbidden. Green soap inunctions added in tubercular peritonitis and surgery if the exudate is encapsulated.

Local abscess—ice applications, atropine and surgical intervention.

Chronic constipation is due to faulty habit, neglect, obesity, sedentary habits, occupation, enteroptosis, weak abdominal muscles, insufficient or unsuitable diet, diseases of stomach and intestines, tabes and intestinal obstructions, strictures and tumors. The disease commences usually with an atony of the colon, followed by catarrh and finally, often after many years, with spastic contraction. In the later stages, constipation changes with diarrhoea to end not infrequently as chronic diarrhoea.

The treatment has to be considered and we have to eliminate the cause. The physiologic methods are indicated. Massage, hydrotherapy, electrotherapy and diet.

If the constipation is due to arteriosclerosis, heart disease, kidney disease, diabetes, etc., laxatives must be administered, castor oil or the salines for occasional use and the milder preparations—*cascara sagrada*, compound licorice powder, rhubarb, etc., for more continued use. The spastic form is best treated with olive oil given by mouth and by high enemas, every night, gradually decreased in number. Laxatives continuously used increase the catarrh. Atropine and belladonna relax, and so do hot teas and hot water, morning and night. Constipation with pain in spastic, without pain atonic.

Parasites in the intestines, discovered in the examination of the stools, have to be treated with the appropriate medicaments.

Round worms with santonin, tape worm with filix mas, pomgranate, etc., and hook worm with thymol. Ulcerations and fissures of the rectum with rest in bed. A diet to produce soft evacuation and local treatment—stretching or cutting of sphincter as last resort.

Ulcers of the colon are treated with warm and astringent enemas, tannin, silver nitrate and alum.

Hemorrhoids, if painful and inflamed, rest in bed with cold application of subacetate of lead and opium and tannin to stop bleeding, until the inflammation is subdued. Oil injections to procure evacuations. Ex. hamamelis, orthoform or annusol suppositories, one morning and night, inserted to cause shrinking.

DISEASES OF THE LIVER.

Catarrhal Jaundice. The liver is usually large, slightly painful, gall bladder frequently visible and palpable. Probably due to a specific infection from the intestines, in some cases, especially when epidemic, in other cases, due to duodenal catarrh. Diet, small amount of fats, otherwise similar to that indicated in gastrointestinal catarrhs and rest in bed, are usually sufficient to cure. Rectal injections of cold water, alkaline mineral waters, sodium salicylate, sodium benzoate, the bile salts, ammonium chloride and the active principles, baptisin, sanguinarin, podophylin, juglandin and others, have been recommended. Calomel is useful for its effect upon the whole intestinal tract and especially upon the circulation, the congested liver becomes measurably smaller after its administration.

Gallstones; colicky pain in liver region, or epigastrium, occasionally with jaundice, frequent vomiting, sometimes fever, gall stones in the dejections, bile in the urine and sausage like tumor at the seat of gall bladder. The physician and surgeon differ widely as to the time of operation. Some surgeons advise an operation as soon as the diagnosis of gallstones is made. It has to be remembered that calculi when quiescent do not cause trouble, and that a large percentage of people, especially the old, have gall stones without symptoms during life and die of some other disease.

Most surgeons do not operate early, but advise the removal of the gall bladder and incarcerated stone, in cases of severe acute and chronic purulent infections.

The physiologic methods are best suited to prevent the trouble and to cure it. Strong abdominal muscles exert pressure from below, backward and upward, and give a natural massage, not alone to the liver, but to all other organs contained in the abdominal cavity, with each ascent and descent of the diaphragm increase intra abdominal pressure and aid the circulation.

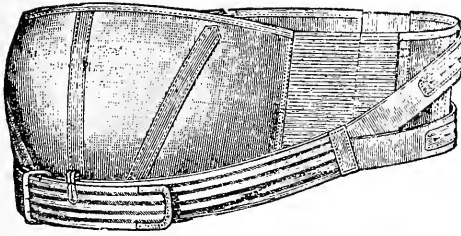
A mixed diet with water between meals, not in excess, stimulates the flow of bile. Exercises to strengthen the abdominal muscles, abdominal breathing, etc. are of importance and a well fitting bandage, one that acts as substitute for the muscles, is needed until these are strengthened.

(Figures 1, 2 and 3)

Morphine and atropine in sufficiently large doses must be given by hypodermic injections during the attack to stop pain, hot applications, hot sitzbath or the full hot bath in some form and hot teas internally to aid. Weakness following the attack has to be treated with stimulants, strong coffee, strychnine, etc. Olive oil taken during the attacks, or after, in large doses is widely used. Calomel, podophylin, the salts of the biliary acids, chologen, etc. may be used with advantage. A treatment at the watering places for those that can afford it, is often of great benefit if no contra-indications, heart and kidney disease, exist. Kalsbad has acquired a world-wide reputation.

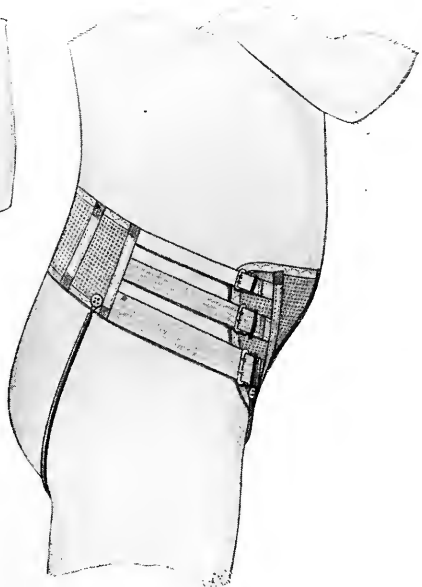
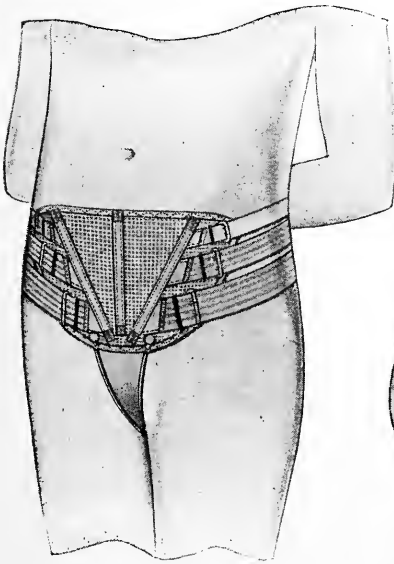
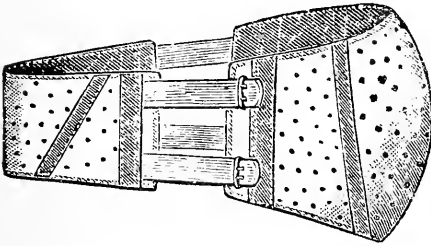
LIVER CIRRHOSIS. Ascites, distention of superficial abdominal veins, large spleen, gastro intestinal catarrh and occasional icterus, and hemorrhages are the cardinal symptoms of advanced cases of Laennec's atrophic cirrhosis. Alcoholism is its most frequent cause, though malaria, syphilis and chronic heart disease may give rise to it. To treat the original cause is the first indication. The earlier the diagnosis is made, the more promising the prospect of cure. The treatment consists in the employment of the physiologic methods, diet, occasionally a pure milk diet, exercise, bath, etc., and mineral waters, best at the watering places. Calomel occasionally given is of advantage. Potassium iodide for continued use has been highly recommended. Chologen and ammonium chloride may be used with advantage. Ascites, hemorrhages, intoxications, etc., have to be treated with the usual means. Talmos operation has not given encouraging results.

The hypertrophic forms of liver cirrhosis characterized by icterus, enlargement of liver and absence of ascites, large spleen



INEFFECTIVE BANDAGES

Figure 1—Thin patients cannot be fitted at all, and fat patients are merely supported, as the badage fits them like a glove. I have designed a bandage which suits the purpose, that is, it restores the pendulous abdomen to the normal or nearly so.



PROPER BANDACES

Figures 2 and 3—It consists of a shield made of cloth, with three whalebones set straight to give it stability, and is placed above the pubic bone. This shield is buckled by three or four straps to a second one, worn across the spine. The lower strap is tight the second less so, and the third is loose, restoring the normal form of the abdomen and exerting the desired pressure upward and backward. I described this bandage in the *New York Medical Record*, December 9, 1905. The bandage is made for me by the Shroeder Surgeons' Supplies Company, New Orleans, Louisiana.

and gastro intestinal catarrh, due to alcoholism and infectious disease, especially syphilis and malaria, has to be treated on similar lines.

DISEASES OF THE HEART. No matter what the character of the disease, as long as the compensation is perfect, the physiologic methods are sufficient to ease heartwork and increase its muscular strength and keep the compensation perfect, if the mode of life is suited to each case. When the first symptoms of heart weakness are observed—indigestion that does not yield to the usual treatment, bronchitis that continues, slight shortness of breath after exertion, anginous and asthmatic attacks, diminution in the quantity of urine voided, dizziness, a congested liver, increase of pulse frequency after slight exertion, low blood pressure, though high pressure may be found when heart disease is due to sclerotic kidneys, a more active treatment has to be commenced, and similar measures have to be used for all to ease heart work and increase its muscular strength. The muscles of the heart and the skeletal muscles correspond. A man with well developed muscles has a strong muscular heart. The obese have weak hearts. Measures adopted that improve the general health, improve the heart muscle. Diseases that cause heart disease have to be thoroughly treated to prevent heart disease; syphilis with mercury; diphtheria with the serum, etc. Articular rheumatism may be prevented by a thorough mouth hygiene and a thorough treatment of every attack of tonsillitis. In the course of infectious diseases, the heart has to be closely watched.

Rest in bed is the best means to prevent endocarditis and myocarditis in these cases. Acute articular rheumatism has to be treated with salicylates, camphor and caffeine for collapse and digitalis in weakness. If endocarditis has left a lesion, to ease heartwork and increase its muscular tone is again the indication and it is of great importance in the application of the physiologic methods to differentiate between the state of compensation and loss of it, that is, the beginning of heart weakness. Of all the drugs to strengthen heart force, digitalis has kept its first place ever since its introduction by Withering about one hundred and twenty-five years ago. This and others have to be used when the physiologic methods have failed to restore compensation. Digitalis acts essentially upon the muscle. It increases blood pressure, slows the pulse and improves its volume, causing a better nutrition of the whole organism and of the heart itself. Digi-

toxin, digalen, strapantus, etc., act in a similar way to digitalis, and in such cases have to be administered. They act best in heart weakness due to valvular lesions.

Digitalis is contra-indicated in diseases of the brain and in aneurysm, and in interstitial nephritis, if increased heart work and blood pressure supercede the benefits derived from its employment. An increased diuresis is the best indicator of improvement. In myocarditis, with advanced degeneration of muscles, digitalis does not act. Adrenalin and adrenogen act sometimes when digitalis has failed. Narcotics have to be used to procure rest, especially in the last stages of the disease. Morphine $\frac{1}{8}$ gr. at night will often stop severe asthmatic attacks and give the patient a night's sleep. In cardiac dropsy, a salt free diet and digitalis preparations. If this is not sufficient to increase the diuresis, other diuretics, caffein, diuretine, etc. have to be added. The hot air bath in bed, with an ice bag to the heart may be used with robust patients, though in general, this treatment is contra-indicated in heart disease. Puncture of the pericardium may become necessary in pericarditis with effusion. The treatment of the "nervous heart" is that of enteroptosis. In this condition, the heart is frequently movable.

The nervines, valerian, the bromides and similar remedies, are useful adjuvants.

Angina pectoris is often relieved by the administration of nitro-glycerine and the nitrites, due to their vaso dilating capacity.

The iodides and digitalis are indicated in all of these cases. A dose of calomel will decrease the size of the heart and diminish the size of a congested liver. It is a valuable remedy to restore the disturbed equilibrium between the arterial and venous circulation, and the heart that has been enabled to empty itself more or less completely, will in many instances keep the tone regained.

PERICARDITIS, often accompanying endocarditis, is to be treated like this disease. Surgical intervention is necessary in purulent cases.

THE DISEASES OF THE VESSELS. Hardening of the arteries is physiologic. The process corresponds to advancing years. This is in some more rapid than in others, due to the material, the wear and tear of daily life, the infectious diseases and various excesses. It is primarily due to toxins that course in the blood and irritate the vascular walls, to abnormal blood distribution, as in enteroptosis, which causes constant vascular

contraction and malnutrition. The treatment of arterio-sclerosis is preventing premature age. The physiologic methods are of the greatest importance, the simple life with sufficient rest, exercise and recreation, especially the rest in the middle of the day and the early bedtime. *Once the heart and vessels are over-taxed, even a prolonged rest will not make up for it.* The diet should be suited to climate and occupation, leaving as little as possible injurious residue, the bath, exercise, etc. are necessary means for prophylaxis and treatment. Gout, alcoholism, syphilis, tobacco, lead intoxication, diabetes and other causes that lead to it have to be thoroughly and efficiently treated. The nitrites and aconite to dilate vessels. The iodides are employed to increase the viscosity of the blood and to absorb morbid tissue. Thio-scinamine may be tried. Circulatory disturbances, heart weakness, emphysema, etc. have to be treated as discussed.

DISEASES OF THE KIDNEYS. The congested kidneys are due to diseases of the heart and lungs. Symptoms of heart weakness, edema of the legs, dyspnoea, cyanosis, concentrated urine of high specific gravity and color and a small amount of albumin are prominent symptoms. The treatment is that of the cause. Heart stimulants are needed, caffen, digitalis, strophantus, etc.

ACUTE HEMORRHAGIC NEPHRITIS—general anasarca, a bloated face, the urine contains a large amount of albumin and blood, granular casts with blood and epithelial cells. The disease may follow an infection or may be due to exposure, chilling of the body, etc. The physiologic methods are of importance,—a salt free diet, withdrawal of meats, hot air bath in bed when edemas are present, with icebag to the heart, the alkaline mineral waters to increase diuresis and in severer cases the vegetable diuretics, sodium benzoate and potassium acetate and caffen, diuretine, etc. Substances that irritate and injure the kidney cells must be strictly avoided.

CHRONIC NEPHRITIS. Large amount of albumin, urine changing in quantity, containing fat granules, waxy casts and epithelial cells in the sediment, are the symptoms. The treatment has to be very much like that of the acute form. With physiologic methods, the salt and meat free diet, intermittent rest, long warm bath, with following pack, to produce diaphoresis and to keep the skin well functioning, the treatment of the cause, infections or exposure, free bowel evacuations and if necessary, diuretics, as before.

THE SCLEROTIC KIDNEY is due to gout, alcoholism, diabetes, enteroptosis, malaria, etc. Large amount of urine, light in color, of low specific gravity; frequent urination at night; small amount of albumin and some hyaline and granular casts;—albumin and casts are frequently absent; changes in other organs; high blood pressure, sclerosed arteries, hypertrophy of the left ventricle and retinitis, characterize the disease.

Treatment—elimination of the cause. The physiologic methods, the diuretics and heart tonics; caffein and diuretics in advanced cases.

Uremic attacks are treated with the hot air bath in bed, camphor and digitalis by hypodermic injections, drastic purgatives and, if this is insufficient, lumbar puncture or venesection followed by infusion of normal salt solution.

DISEASES OF THE NERVOUS SYSTEM. The functional neuroses, hysteria and neurasthenia, always associated with displacement of the abdominal organs, with low diaphragm and more or less movable heart, are due to circulatory disturbances. They have to be treated and are all benefited and usually cured by treating the enteroptosis.

EPILEPSY. If the epilepsy is due to syphilis, a strong specific treatment is indicated. If due to trauma, a surgeon has to be consulted, and if organic disease is present, this has to be considered. If no cause can be found, a quiet, easy, well regulated life, will reduce severity and frequency of attacks. A salt free diet suited to each case, climate, etc. *Alcohol is poison to the epileptic.* The bromides are the most widely used remedies. Best given in one large dose at night, in a cup of valerian tea, the dose must be sufficiently large to stop the attacks, 60 grs. more or less. The treatment is to be continued for at least a year and the dose gradually lessened. If the stomach revolts, a night and morning dose may be given instead. Free elimination by bowels, skin and kidneys is of great importance. The treatment with the bromides is indicated when the patient suffers from frequent attacks. Intramuscular injections of sodium cacodylate alone or in combination with the bromides give good results.

Atropine ranks next to the bromides in the treatment of epilepsy, especially useful when the pulse is tense and the arteries contracted. Nitro-glycerine is also useful in these cases, especially when the skin is cold and clammy. A very large number of medicaments that have not stood the test have been recommended from time to time.

TABES DORSALIS. Pupil reflex to light and knee reflex lost, lancinating pains in the legs, ataxia, Rombergs sign, analgesias, paresthesias, gastric crisis and girdle sensations, are the most prominent symptoms. A thorough treatment of lues, will best prevent tabes. The physiologic methods, hydrotherapy, electrotherapy, exercise, etc., must be used as soon as the diagnosis is made and the earlier, the better the prognosis. Specific treatment should be tried. Cacodylate of soda injections are of benefit. **The analgesics, antipyrine, pyranidon, asperin, etc., for pain. The narcotics with caution. Atropine injections act well in crises when the arteries are contracted. The hard tense pulse during the attacks becomes soft, the pain diminishes and ceases.**

CEREBRAL HEMORRHAGE. Arterio-sclerosis and interstitial nephritis are usually the remote cause, sudden onset, hemiplegia often without aphasia and stupor, the cardinal symptoms. The physiologic methods to prevent the attacks are diet, rest, quiet life, open bowels, etc. The attacks have to be treated with **absolute rest in bed, head raised, ice bag to the head, venesection** in robust patients and wet cupping. Drastics or the quick acting laxatives and narcotics in states of excitement. If the heart is weak, stimulants are needed, camphor, caffein, digitalis, etc. After the acute attack has passed, potassium iodide, it is thought, **causes absorption of the clot, later, after three or four weeks have passed, massage, hydrotherapy and electrotherapy.**

RAYNAUD'S DISEASE is due to a neurosis or to tabes dorsalis, syringomyelia, epilepsy, etc. It begins with pains in finger tips, toes, nose, or ears, and leads to local asphyxia and dry gangrene. The course of the disease is intermittent. General and local treatment with physiologic methods. Internally, analgesics and narcotics to stop the severe pains and finally operation. The nitrites have not given any results.

I have treated a number of these cases with atropine, by hypodermic injections with success, resulting in perfect cure; among them a patient who had several toes amputated and one who came to me when told by an eminent surgeon that an operation would be necessary, and a diabetic who came every five or six months when he noticed his toes turn black. The first mentioned case has been published from my clinic by Dr. Fossier in the New Orleans Medical and Surgical Journal. Though I have treated but a limited number, I have not failed in one and think atropine should be tried in every case of Raynaud's disease,

regardless of cause. Its action is evidently due to its antispasmodic power. Pain stops and analgesics become unnecessary. The other nervous diseases have to be treated along similar lines.

This book has been written to show how to assist nature to cure disease and that to make the blood as perfect as possible and to bring it where it is needed must be the basis of all treatment. Necessarily each chapter had to be short and no treatment has received a preference—all serve the same purpose, and all are of value, they all influence blood circulation and nature cures by way of the blood.

Some may think the book too short and incomplete. It should be remembered that it was written mainly for the purpose of showing that blood alone cures, and that therapeutic methods must be combined to produce pure blood and hyperemia. I hope I have accomplished this and that it will help to relieve suffering and cure disease.

APPENDIX

ACIDA

Acidum aceticum dilutum 2-4 fl drs.
Acidum benzoicum 10-30 grs.
Acidum boricum 5-15 grs.
Acidum carbolicum $\frac{1}{2}$ -2 m.
Acidum citricum 10-30 grs.
Acidum gallicum 5-20 grs.
Acidum hydrobromicum dilutum 30-90 m.
Acidum hydrochloricum dilutum 10-30 m.
Acidum hydrocyanicum dilutum 2-5 m.
Acidum lacticum 15-30 m.
Acidum nitricum dilutum 5-30 m.
Acidum nitro-hydrochloricum dilutum 5-20 m.
Acidum phosphoricum dilutum 20-60 m.
Acidum salicylicum 10-40 grs.
Acidum sulphuricum aromaticum 10-20.
Acidum sulphuricum dilutum 15-30 m.
Acidum tannicum 2-20 grs.
Acidum tartaricum 10-30 grs.

AETHER (ether) 10-60 m. hypoderm 15-30 m.

Aceticus

Aetheris compositus spiritus 1 drm.

Aetheris nitrosi spiritus 1 drm.

AMONII PRAEPARATA

Beuzaas 10-30 grs.
Bromidum 15-30 grs.
Carbonas 5-20 grs.
Chloridum 5-20 grs.
Iodidum 3-10 grs.
Aqua ammoniae 10-30 m.
Spiritus ammoniae 20-60 m.
Spiritus ammoniae aromaticus 20-60 m.

AMYL NITRIS (1-3 drops).

ANTIFEBRIN (see Acetanilid).

ANTIPYRINE 10-20 grs.

Salicylate 10-30 grs.

APOMORPHINAE HYDROCHLORAS

Hypodermically (Emetic) $1/15$ - $1/8$ grs.

ARSENII PRAEPARATA

Acidum arsenosum $1/60$ - $1/20$ grs.

Arseni iodidum $1/60$ - $1/15$ grs.

Liquor potassii arsenitis (Fowler's solution) 1-5 m.

Liquor sodii arsenatis 1-5 m.

Sodii arsenas $1/16$ - $1/8$ gr.

ASAFOETIDA 5-15 grs.

Emulsum asafoetidae 2-6 fl. drs.

Pipulae asafoetidae 3-5 grs.

Tinctura asafoetidae 20-60 m.

ATROPINE (See Belladonna) $1/120$ - $1/50$ grs.

BALSAMUM TOLUTANUM 10-30 grs.

Syrupus tolutanus 1-3 fl. drm.

Tinctura tolutana 1-2 fl. drm.

BELLADONNA (root of leaves)

Atropinae sulphas grs. $1/200$ - $1/50$.

Atropinae sulphas, hypodermically grs. $1/200$ - $1/50$.

Extractum belladonnae foliorum alcoholicum $1/8$ - $1/2$ grs.

Extractum belladonnae radices fluidum $1/2$ -2 grs.

Tinctura belladonnae foliorum 5-20 m.

CAFFEINA 1-5 grs.

Citrata 2-10 grs.

Valerianate 3-5 grs.

CALOMEL (see Hydrargyri Praeparata).

CAMPHORA 2-5 grs.

Monobromata 2-5 m.

Aqua camphorae 8-30 grs.

Camphoric acid

Spiritus camphorae 1 fl. drm.

CANNABIS INDICA

Extractum cannabis indicae $1/4$ -1 grs.

Extractum cannabis indae fluidum 2-5 m.

Tinctura cannabis indicae 5-20 m.

CHLORAL HYDRATE 10-30 grs.

CHLOROFORM 2-5 m.

Aqua chloroformi $\frac{1}{2}$ -2 fl. oz.

Emulsum chloroformi 30-60 m.

Spiritus chloroformi 30-60 m.

CINCHONA 5-15 grs.

Extractum cinchonae 1-10 grs.

Extractum chinchonae fluidum 5-120 m.

Infusum cinchonae $\frac{1}{2}$ -1 fl. oz.

Quinine, official salts of 2-15 grs.

Tinctura cinchonae 1-2 fl. drs.

COCAINAE HYDROCHLORAS $\frac{1}{2}$ -1 $\frac{1}{2}$ grs.

CODEINA $\frac{1}{2}$ -2 grs.

COLCHICUM

Colchicine 1/20-1/30 grs.

Extractum colchici radices $\frac{1}{2}$ -2 grs.

Extractum colchici radices fluidum 2-8 m.

Extractum colchici seminis fluidum 3-10 m.

Tinctura colchici seminis 20-60 m.

Vinum colchici radices 5-20 m.

Vinum colchici seminis 20-60 m.

CONVALLARIA 1-6 grs.

Extractum convallariae fluidum 15-30 m.

CREOSOTUM 2-5 m.

Aqua cresoti 1-4 fl. grs.

CROTON OIL (See Oil/Tiglii) 1-2 m.

CUSSO (Brayera)

Extractum cusso fluidum 2-6 fl. drm.

DERMATOL 4-8 grs.

DIGITALIS

Digitalin $\frac{1}{4}$ - $\frac{1}{2}$ grs.

Extractum digitalis 1-3 m.

Extractum digitalis fluidum 1-3 m.

Infusum digitalis 1-4 fl. drs.

Tinctura digitalis 5-20 m.

DIURETIN 15 grs.

ELATERINUM $\frac{1}{8}$ - $\frac{1}{2}$ grs.

EMETINE (See Ipecacuanha) $1/12$ - $1/6$ grs.

EPSOM SALT (see Magnesii Praeparata) 2 drms.-1 oz.

ERGOT 20-90 grs.

Ergotine 3-10 grs.

Extractum ergotae 5-15 grs.

Extractum ergotae fluidum $1/2$ -2 fl. drs.

Vinum ergotae 2-8 fl. drs.

ESERINE (see Physostigma) $1/120$ - $1/30$ grs.

GELSEMIUM 3-10 grs.

Extractum gelsemii fluidum 2-5 m.

Tinctura gelsemii 10-30 m.

GUAIACOL 2 m.

Carbonate 4-8 grs.

HAMAMELIS 15-60 grs.

Extractum hamamelidis fluidum 15-60 m.

HYDRARGYRI PRAEPARATA

Chloridum corrosivum $1/60$ - $1/12$ grs.

Chloridum mite (calomel) $1/3$ -10 grs.

Cyanidum $1/12$ - $1/6$ grs.

Iodidum flavum $1/2$ -2 grs.

Iodidum rubrum $1/16$ - $1/4$ grs.

HYOSCYMUS (leaves and tops) 5-15 grs.

Extractum hyoscyami 1-3 grs.

Extractum hyoscyami fluidum 5-15 m.

Hyoscine hydrochlorate $1/400$ - $1/30$ grs.

Hyoscyaminae hydrobromas $1/400$ - $1/30$ grs.

Hyoscyaminae sulphas $1/8$ - $1/4$ grs.

Tinctura hyoscyami 20-60 m.

ICTHYOL 3-30 m.

IODIFORMUM 1-3 grs.

IODUM

Liquor iodi compositus (Lugol's) 2-10 m.

Tinctura iodi 2-5 m.

IPECACUANHA, as expectorant

Emetine $1/12$ - $1/6$ grs.

Extractum ipecacuanhae fluidum $1/2$ -20 m.

Pulvis ipecacuanhae et opii (see opium) 5-20 grs.
Syrupus ipecacuanhae, as expectorant 10 m-6 fl. drs.
Tinctura ipecacuanhae et opii (see opium) 5-15 m.
Vinum ipecacuanhae 5 m.-3 fl. drs.

JALAPA 15-30 grs.

Extractum jalapae 2-5 grs.
Pulvis jalapae compositus 20-60 grs.
Resina jalapae 1-3 grs.

LOBELIA 2-10 grs.

Extractum lobeliae fluidum 2-10 m.
Tinctura lobeliae 10-40 m.

MENTHA

Oleum menthae piperitae 1-5 min.
Oleum menthae viridis 1-5 min.
Spiritus menthae piperitae 10-30 min.
Spiritus menthae viridis 10-30 min.

NAPHTHALINUM 2-8 grs.

NITROGLYCERINUM gr. 1/150-1/50.

NUX VOMICA 1-5 grs.

Brucine 1/12-1/2 gr.
Extractum nucis vomicae 1/8-1/2 gr.
Extractum nucis vomicae fluidum 1-5 m.
Strychninae sulphas 1/60-1/15 gr.
Tinctura nucis vomicae 5-20 m.

OPIUM 1/2-2 grs.

Codeina 1/2-2 grs.
Deodoratum 1/2-2 gr.
Extractum opii 1/4-1 gr.
Morphinae acetas, internally and hypodermically 1/8-1/2 gr.
Morphinae sulphas, internally and hypodermically 1/8-1/2 gr.
Pulvis ipecacuanhae et opii (Dover's powder) 5-10 gr.
Pulvis morphinae compositus 5-10 gr.
Tinctura ipecacuanhae et opii 5-15 min.
Tinctura opii comphorata (paregoric) 1/2-4 fl. dr.
Tinctura opii deodorati 5-20 min.
Tinctura opii (laudanum) 5-20 min.
Vinum opii 5-20 min.

PANCREATINUM 5 gr.

PEPPERINT (see *Mentha*)

PEPSINUM 5-15 grs.

Sacharatum 60-150 grs.

PHENACETINE 8-10 grs.

PHYSOSTIGMA

Eserine (not official) 1/120-1/30 grs.

Extractum physostigmatis 1/12-1/4 grs.

Tinctura physostigmatis 5-15 m.

PILOCARPUS 10-30 grs.

Extractum pilocarpi fluidum 10-30 grs.

PLUMBI PRAEPARATA

Acetas 1-4 grs.

iodidum 1-4 grs.

Nitras 1-4 grs.

PODOPHYLLUM 5-30 grs.

Extractum podophylli 2-5 grs.

Extractum podophylli fluidum 10-30 m.

Resina podophylli 1/8-1/2 grs.

POTASSII PRAEPARATA

Acetas 10-60 grs.

Bicarbonas 20-60 grs.

Bichromas 1/16-1/4 grs.

Bitartras 1-8 drams.

Bromidum 15-90 grs.

Carbonas 10-30 grs.

Chloras 10-20 grs.

Citras 10-40 grs.

Cyanidum 1/8 grs.

Hypophosphis 10-30 grs.

Iodidum 8-30 grs.

Nitras 10-60 grs.

Permanganas 1-3 grs.

et sodii tartras (Rochelle salt) 1/2-1 oz.

Sulphas 20-240 grs.

QUASSIA 10-30 grs.

Extractum quassiae 2-5 grs.

Extractum quassiae fluidum 10-30 grs.

Tinctura quassiae 1-3 fl. drs.

Quassine 1-30.

QUILLAJA 10-30 grs

Tinctura quillajae 20-60 m.

QUININE SALTS (see Cinchona)

RESORCINE 2-45 grs.

RHUBARB 3-10 grs.

Extractum rhei 1-10 grs.

Extractum rhei fluidum 5-30 m.

Pulvis rhei compositus 30-120 grs

Syrupus rhei 1 fl. dr.

Tinctura rhei 1-4 fl. drs.

RUMEX.

Extractum rumicis fluidum 1 drm.

SALOL 5-15 grs.

SANGUINARIA, as emetic 3-20 grs.

Extractum sanguinariae fluidum 3-20 m.

Tinctura sanguinariae 15-60 m.

SANTONICA

Santoninum 2-4 grs.

SARSAPARILLA 30-120 grs.

Extractum sarsaparillae fluidum 30-120 m.

SCILLA

Acetum scillae 10-30 m.

Extractum scillae fluidum 1-3 m.

Syrupus scillae $\frac{1}{2}$ -1 fl. drm.

Syrupus scillae compositus 10-60 m.

Tinctura scillae 5-20 m.

SENNA 1-4 drams.

Extractum sennae fluidum 1-4 fl. drs.

Syrupus sennae 1-2 fl. drs.

SODII SULPHOCARBOLATE 5-20 grs.

SODII PRAEPARATA

Acetas 15-90 grs.

Benzoas 10-40 grs.

Bicarbonas 10-60 grs.
 Boras 20-40 grs.
 Bromidum 10-60 grs.
 Carbonas 5-20 grs.
 Chloras 5-15 grs.
 Hypophosphis 10-30 grs.
 Iodidum 5-60 grs.
 Sodium Cocodylate $\frac{1}{2}$ -7 grs.
 Nitras 10-60 grs.
 Phosphas 5-40 grs.
 Salicylas 5-40 grs.
 Sulphas (Glauber's salt) 2-8 drs.
 Sulphis 10-60 grs.

SPARTEINAE SULPHAS $\frac{1}{4}$ -1 grs.

STRONTII PRAEPARATA

Bromidum 10-40 grs.
 Iodidum 10-20 grs $\frac{1}{4}$
 Lactas 10-20 grs.

STROPHANTHUS

Strophanthin 1/240-1/60 grs.
 Tinctura strophanthi 3-10 m.

STRYCHNINE (see Nux Vomica) 1/60-1/15 grs.

SULPHONAL 15-30 grs.

TEREBINTHINA

Oleum terebinthinae 10-30 m.
 Oleum terebinthinae retificatum 1-2 fl. drms. as anthelmintic.
 Oleum terebinthinae, as anthelmintic 1-2 fl. drs.

THYMOL 1-10 grs.

Mucilago tragacanthae

VALERIANA 10-30 grs.

Ammonii valerianas 1-5 grs.
 Extractum valerianae fluidum 10-30 m.
 Tinctura valerianae 1-2 fl. drs.
 Tinctura valerianae ammoniata 1-2 fl. dr.

VERATRUM VIRIDE 1-3 grs.

Extractum veratri viridis fluidum 1-4 m.
 Tinctura veratri viridis 3-10 m.
 Veratrine 1/60-1/20 grs.

VIBURNUM

Extractum viburni prunifolli fluidum 15-60 m.

ZINCI PRAEPARATA

Brimidum 1-2 grs.

Phosphidum $1/20$ - $1/4$ grs.

Sulphas $1/4$ - $1/2$ grs.

Valerianas 1-5 grs.

Sulphocorbolate 2-10 grs.

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